BIBLIOGRAPHIC DATA SHEET	1. Report No. APTD-0895	2.	3. Recipient's Accession No.
4. Title and Subtitle Pittsburgh Metropolitan Area Air Pollutant Emission Inventory			5. Report Date November 1968 6.
7. Author(s) Michael J. McGraw, Charles S. Holt			8. Performing Organization Rept. No.
9. Performing Organization Name and Address U. S. Department of Health, Education, and Welfare National Air Pollution Control Administration Air Quality and Emission Data Division Durham, North Carolina			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address Same			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts

A report is presented of the results of an emission inventory of air pollutant sources in the Pittsburgh Metropolitan Area. A modified version of the rapid survey technique was used. The objectives of the study were to determine the total quantities of the various air pollutants emitted and to estimate their seasonal and geographical variation. To accomplish this task, the study area was divided into a grid coordinate system, and the emission quantities were reported in terms of tons of pollutant per grid for a summer, winter, and average day. The pollutants considered were sulfur oxides, particulates, carbon monoxide, nitrogen oxides and hydrocarbons. All major source categories except solvent evaporation were included in the survey.

17. Key Words and Document Analysis. 17a. Descriptors

Air pollution
Emission
Inventories
Particles
Sulfur oxides
Carbon monoxide
Nitrogen oxides
Hydrocarbons
Sources
Seasonal variation
Distribution (property)

17b. Identifiers/Open-Ended Terms

Pittsburgh, Pennsylvania
Particulates

17c. COSATI Field/Group 13B

18. Availability Statement Unlimited	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 66
	20. Security Class (This Page) UNCLASSIFIED	22. Price $3.00/.95

FORM NTIS-38 (10-70)

USCOMM-DC 40329-P71

0895

PB 207 648

PITTSBURGH METROPLITAN AREA AIR POLLUTANT EMISSION INVENTORY

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Public Health Service
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0895

PITTSBURGH METROPOLITAN AREA AIR POLLUTANT EMISSION INVENTORY

Prepared by:

Michael J. McGraw
Charles S. Holt

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Consumer Protection and Environmental Health Service
National Air Pollution Control Administration
Air Quality and Emission Data Division
Durham, North Carolina
November, 1968

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ACKNOWLEDGMENTS

We acknowledge with appreciation the many contributions of cooperating agencies in the gathering of the data for this report. In particular, we are grateful for the use of data and personnel assistance furnished by the following:

1. Bureau of Air Pollution Control, Allegheny County Health Department,
2. Pennsylvania Division of Air Pollution Control, Department of Health.

INTRODUCTION

This report presents the results of an emission inventory of air pollutant sources in the Pittsburgh metropolitan area. A modified version of the rapid survey technique[1] was employed in this survey. The objectives of this study were to determine the total quantities of the various air pollutants emitted and to estimate their seasonal and geographical variation. To accomplish this task, the study area was divided into a grid coordinate system, and the emission quantities were reported in terms of tons of pollutant per grid for a summer, winter, and average day.

The pollutants considered in the survey were sulfur oxides, particulates, carbon monoxide, nitrogen oxides and hydrocarbons. Data presented herein should be representative, for the most part, of 1967 and were mainly gathered by the acknowledged State and local agencies. All major source categories except solvent evaporation were included in the survey.

STUDY AREA

The emission survey of the Pittsburgh area was confined to the Pittsburgh Standard Metropolitan Statistical Area (SMSA). This area consists of four counties: Allegheny, Beaver, Washington, and Westmoreland. The four county area is located in the southwest corner of the state, west of the Appalachian mountains (Figure 1). The Steubenville SMSA is located directly west of the Pittsburgh Study Area and borders Beaver and Washington counties.

Figure 2 represents a more detailed drawing of the Pittsburgh Study Area. The urbanized portion of Pittsburgh is located at the confluence of the Allegheny and the Monongahela Rivers, which form the Ohio River. The Study Area occupies 3,054 square miles and contains an estimated 1967 population of 2,522,000 which is

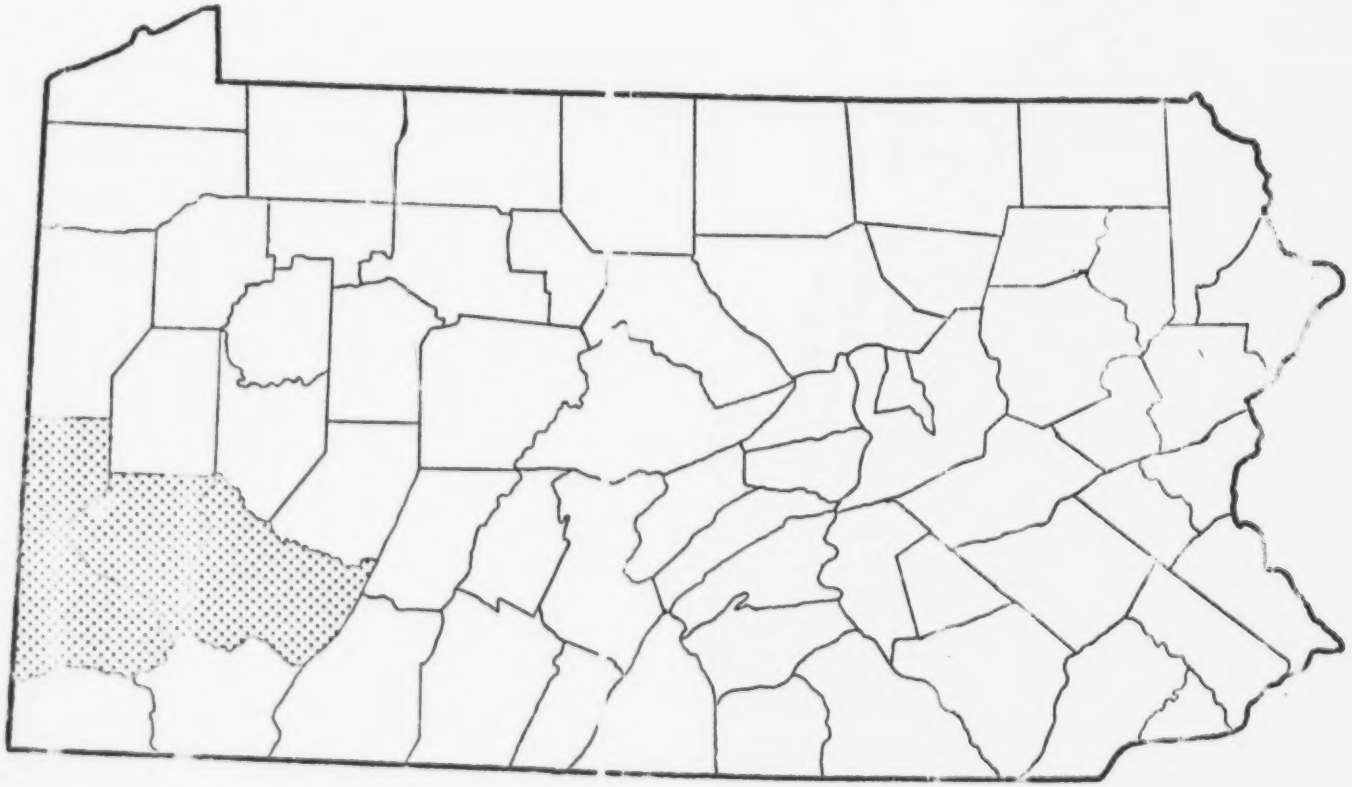

Figure 1. Map of the State of Pennsylvania Showing Pittsburgh Study Area.

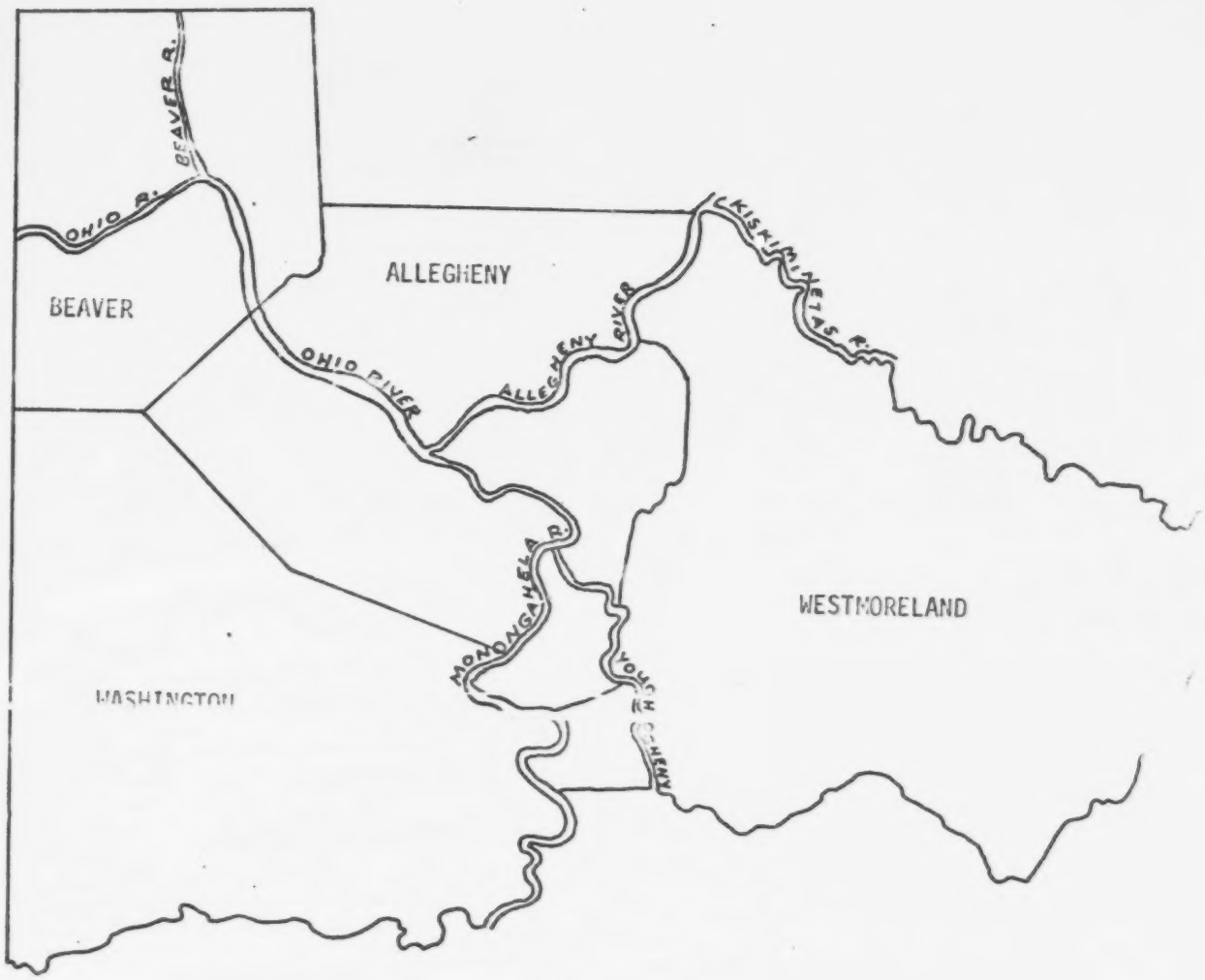

Figure 2 Pittsburgh Study Area

approximately a 5 percent increase since 1960 (Table 1).[2] The population density map (Figure 3) shows that the heaviest population is concentrated along the rivers.

TOPOGRAPHY

The industry and population of the Study Area have developed along the river valleys of the Monongahela, Allegheny, and Ohio Rivers. The flatlands of the river valleys have provided ideal locations for steel mills and other heavy industry. The rivers themselves are used extensively for the transport of raw materials and finished products. Away from the river valleys the land rises steeply. The topography is rugged and hilly. The elevation increases toward the eastern edge of the Study Area, forming the foothills of the Appalachian mountains.

The hilly terrain and deep river valleys in the Study Area provide a sort of "air drainage" system[3]. Cool air follows the topographical "sinks" in the region. These sinks are often capped by local temperature inversions, which cause air pollutants to build up. Air pollution problems are intensified by the fact that industry has concentrated in the deep river basins, hindering lateral dispersion of pollutants.

GRID COORDINATE SYSTEM

The grid reference system used in the emission survey of Pittsburgh is based on the Universal Transverse Mercator Projection (UTM). Using a basic unit grid square - 5,000 feet on a side - 81 grid squares of several sizes were defined for the Study Area.

The grids defined for the reference system are of three sizes - 5,000, 10,000, and 20,000 meters squared. The smaller grids were used on the densest areas of population and industry in order to

Table 1

PITTSBURGH STUDY AREA CHARACTERISTICS, 1967

Political Jurisdiction	Land Area (sq. mi.)	Population 1960	Population 1967	Population Density (1967)
Allegheny County	731	1,629,000	1,699,000	2,324
Beaver County	441	207,000	225,000	510
Washington County	857	217,000	221,000	258
Westmoreland County	1,025	353,000	377,000	368
Total Study Area	3,054	2,406,000	2,522,000	826

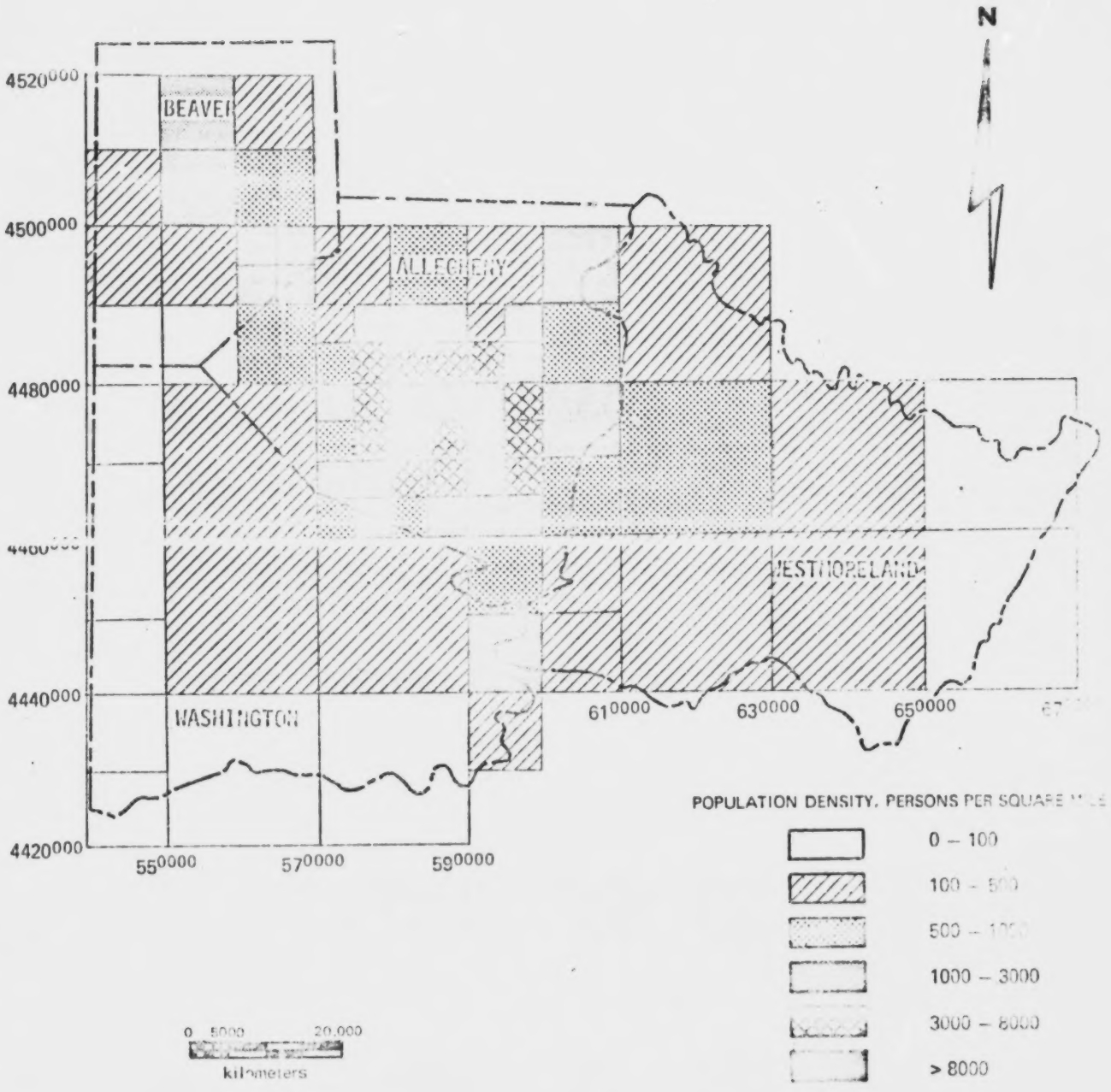

Figure 3. Population density for Pittsburgh study area, 1967.

more accurately depict these areas. Thus at the confluence of the Monongahela and the Allegheny Rivers in central Allegheny county and along the Ohio River Valley in the Southeast corner of Beaver county, 5,000 meter squares were used. In Areas low in population such as eastern Westmoreland and southern Washington counties, 20,000 meters squares were used. In those cases where sections of outlying counties are omitted, the air pollutant emissions are considered negligible.

Figure 4 shows the grid reference system utilized for the Pittsburgh emission survey.

SUMMARY OF RESULTS

The following is a brief summary of pollutant emissions and sources in the Study Area:

1. Sulfur oxides (over 930,000 tons per year) are emitted primarily from fuel combustion in stationary sources (77 percent). The combustion of coal by industrial sources contributed 46 percent and steam electric utilities accounted for 25 percent of the total sulfur oxides emitted. Industrial process losses accounted for another 21 percent and transportation sources 2 percent.
2. Stationary fuel combustion sources contributed 73 percent of the total particulate emissions of about 386,000 tons per year. Transportation sources contributed 2 percent; industrial processes 24 percent; and refuse burning 1 percent.
3. The major source of carbon monoxide (915,000 tons per year) was the operation of gasoline powered motor vehicles which emitted 91 percent of the total. Diesel powered vehicles and air traffic emit 1 percent

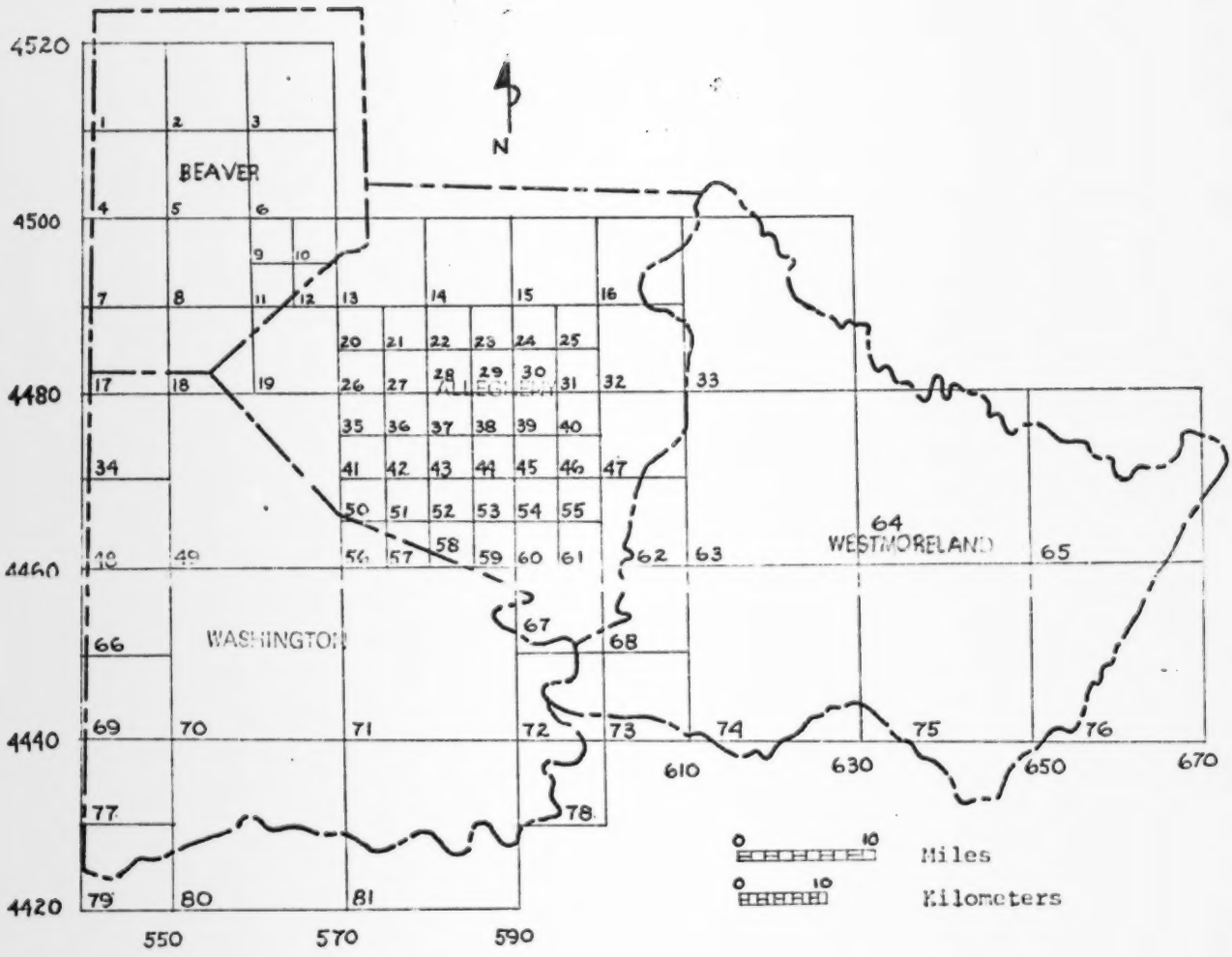

Figure 4 Grid Coordinate System for Pittsburgh Air Pollutant Study Area

of the total emissions. Of the remaining 8 percent, 6 percent comes from stationary fuel combustion and 2 percent from refuse burning. Information was not available on carbon monoxide emissions from industrial processes.

4. Oxides of nitrogen (266,000 tons per year) were discharged primarily from coal combustion in steam electric utilities (29 percent) and in industrial plants (41 percent). Natural gas consumption accounted for 7 percent of the total emissions; and transportation sources 19 percent. Sources such as residential and institutional fuel consumption, refuse burning and industrial process losses accounted for the remaining 4 percent.
5. Motor vehicles emit approximately 84 percent and stationary fuel combustion 16 percent of the total hydrocarbons included in this survey. Total hydrocarbon emissions were approximately 95,000 tons per year (excluding solvent evaporation and industrial process losses).

The emissions of pollutants discharged to the air in the Study Area are summarized in Table 2. The breakdown of all emissions on a county basis are summarized in Tables 3-6. The validity of these results are dependent on the accuracy and applicability of the emission factors used.[4] These factors, for the most part, represent the average emission rates for a particular industry or fuel group. Because of the inherent differences in type of equipment, operating rates, and efficiency of operation among the plants or fuel users within a given category, the application of the emission factors to any individual plant or even a smaller number of similar plants or processes may result in a discrepancy between the actual and the estimated emissions. However, the estimates of total pollutants from all sources in the study area should be fairly accurate since the emission factors are based on average conditions.

Table 2 SUMMARY OF AIR POLLUTANT EMISSIONS IN PITTSBURGH STUDY AREA, 1967 (TONS/YEAR)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Nitrogen Oxides	Hydro-carbons
Transportation					
Road Vehicles	4,300	7,000	833,200	46,400	75,700
Other	650	2,300	16,000	4,570	5,100
Total	4,950	9,300	848,700	51,000	79,900
Combustion of Fuels Stationary Sources					
Industry	435,100	126,400	15,700	119,600	6,000
Steam-Electric Util.	235,600	130,300	1,900	76,500	800
Residential	25,800	16,400	15,800	9,200	3,200
Commercial & Institutional	29,600	8,700	21,700	5,200	4,900
Total	726,100	281,800	58,100	210,500	14,900
Refuse Disposal					
Incineration	478	2,010	250	480	80
Open Burning	196	1,570	8,380	1,080	495
Total	675	3,580	8,630	1,560	575
Industrial Process Emissions	202,200	91,900	NA	3,500	NA
Totals	933,900	386,600	915,400	266,600	95,400

NA = Information not available or not reported

Table-3 SUMMARY OF EMISSIONS IN ALLEGHENY COUNTY, 1967 (TONS/YEAR)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Nitrogen Oxides	Hydro-carbons
Transportation					
Road Vehicles	2,600	4,400	509,800	25,400	46,300
Aircraft	N	535	14,490	1,040	2,945
Railroads	505	1,390	760	2,800	1,720
Vessels	130	360	200	730	445
Total	3,200	6,700	525,300	30,000	51,400
Combustion of Fuels Stationary Sources					
Industry	49,300	22,600	1,500	16,600	1,200
Steam-Electric Util.	137,100	85,000	900	36,050	550
Residential	4,200	3,190	2,520	4,910	515
Commercial & Institutional	9,250	3,530	5,790	2,430	1,150
Total	199,900	112,300	10,700	60,000	3,200
Refuse Disposal					
Incineration	450	1,890	230	450	75
Open Burning	100	790	4,190	545	250
Total	550	2,680	4,420	1,000	325
Industrial Process Emissions	179,000	68,400	N	3,300	N
Totals	382,600	190,100	540,400	94,500	54,900

N = Negligible

Table 4 SUMMARY OF EMISSIONS IN BEAVER COUNTY, 1967 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Nitrogen Oxides	Hydrocarbons
Transportation					
Road Vehicles	350	620	2,400	4,300	7,000
Other	15	40	20	70	45
Total	350	600	77,400	4,400	7,000
Combustion of Fuels Stationary Sources					
Industry	158,900	46,000	5,700	43,000	1,900
Steam-Electric Util.	0	0	0	0	0
Residential	4,330	2,660	2,630	890	540
Commercial & Institutional	7,450	1,840	4,650	1,120	930
Total	170,700	50,500	13,000	45,000	3,400
Refuse Disposal					
Incineration	20	90	10	20	5
Open Burning	25	220	1,160	150	70
Total	45	310	1,170	170	75
Industrial Process Emissions	14,200	21,500	NA	NA	NA
Totals	185,300	73,000	91,600	50,000	10,500

NA = Information not available or not reported

Table 5 SUMMARY OF EMISSIONS IN WASHINGTON COUNTY, 1967 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Nitrogen Oxides	Hydrocarbons
Transportation					
Road Vehicles	500	1,900	100,700	5,600	9,200
Other	N	N	N	N	N
Total	500	1,900	100,700	5,600	9,200
Combustion of Fuels Stationary Sources					
Industry	163,400	39,800	6,110	41,900	2,100
Steam-Electric Util.	76,400	41,700	870	34,800	350
Residential	7,260	4,430	4,500	1,060	905
Commercial & Institutional	8,600	2,170	10,400	1,810	2,090
Total	255,700	87,100	21,900	79,600	5,400
Refuse Disposal					
Incineration	5	30	5	5	N
Open Burning	25	195	1,050	135	60
Total	30	225	1,055	140	60
Industrial Process Emissions	NA	NA	NA	NA	NA
Totals	256,200	89,200	123,700	85,300	14,200

N = Negligible

NA = Information not available or not reported

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Table 6 SUMMARY OF EMISSIONS IN WESTMORELAND COUNTY, 1967 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Nitrogen Oxides	Hydrocarbons
Transportation					
Road Vehicles	800	1,200	145,500	8,100	13,200
Other	N	N	N	N	N
Total	800	1,200	145,500	8,100	13,200
Combustion of Fuels Stationary Sources					
Industry	63,500	18,000	2,400	18,000	800
Steam-Electric Util.	22,100	6,560	130	5,530	55
Residential	10,000	6,100	6,350	1,700	1,250
Commercial & Institutional	3,700	1,180	3,870	650	775
Total	99,300	31,800	12,500	25,900	2,900
Refuse Disposal					
Incineration	0	0	0	0	0
Open Burning	50	370	1,970	255	115
Total	50	370	1,970	255	115
Industrial Process Emissions	9,000	2,050	NA	NA	NA
Totals	109,100	35,400	160,000	34,300	16,200

NA = Information not available or not reported

EMISSIONS BY CATEGORY

For the purposes of compiling the basic data and emission estimates, the air pollutant sources were classified into the following four categories:

1. Fuel combustion in stationary sources
2. Transportation
3. Solid-waste disposal
4. Industrial process losses

Fuel Combustion in Stationary Sources

Although all of the three major fuels are consumed within the Study Area, coal is the most significant. As shown in Table 7 approximately 35 million tons of coal (15 million tons for coke production), 179 million gallons of fuel oil, and 225 billion cubic feet of natural gas were consumed in the Study Area. The breakdown of fuel consumption by user category and by jurisdiction is shown in this same table.

The seven steam-electric generating plants within the Study Area consumed 22 percent of the total coal utilized by all sources. Industry is the other prime user of coal consuming 74 percent of the total.

Fuel oil is consumed mainly in industrial operations (75 percent) and for residential heating purposes (18 percent).

Industrial sources consume 40 percent of the natural gas in the Study Area; residential heating 45 percent; and commercial and institutional 15 percent. Natural gas is not utilized in the steam-electric generating plants.

Approximately 85 percent of the dwelling units in the Study Area use gas as the heating fuel (Table 8). Coal was used in 11 percent and fuel oil 4 percent of the total dwelling units. Close to 100 percent of the residences in the urbanized portion of the

Table 7 ANNUAL FUEL CONSUMPTION IN POLITICAL SUBDIVISIONS OF THE PITTSBURGH STUDY AREA, 1967

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Fuel	Jurisdiction	Industry	Steam-electric Plants	Residential	Commercial & Institutional	Totals
Coal, tons/year	Allegheny County	16,400,000	3,750,000	96,000	232,000	20,478,000
	Beaver County	3,710,000	---	106,000	186,000	4,002,000
	Washington County	4,200,000	3,490,000	130,000	211,000	8,031,000
	Westmoreland County	1,650,000	547,000	245,000	80,000	2,522,000
	TOTALS	25,800,000	7,790,000	627,000	709,000	35,000,000
Fuel oil 1000 gal/year	Allegheny County	33,100	170	10,900	3,100	47,300
	Beaver County	78,000	---	6,100	1,740	85,800
	Washington County	15,200	250	3,890	1,100	20,400
	Westmoreland County	8,600	1,180	12,100	3,450	25,300
	TOTALS	134,900	1,600	33,000	9,400	178,900
Gas, million cubic feet/year	Allegheny County	40,300	---	76,700	26,000	143,000
	Beaver County	27,000	---	7,500	2,900	37,400
	Washington County	9,300	---	5,400	1,700	16,400
	Westmoreland County	13,400	---	11,200	3,700	28,300
	TOTALS	90,000	---	100,800	34,300	225,000

15,000,000 Tons/year consumed for coke production

Table 8 SUMMARY OF DOMESTIC HEATING BY NUMBER OF DWELLING UNITS IN PITTSBURGH STUDY AREA, 1967

Type Fuel	Allegheny County	Beaver County	Washington County	Westmoreland County	Study Area	Percent of total
Coal	13,400	14,400	13,700	37,600	79,100	10.7
Fuel Oil	9,620	5,490	3,500	10,700	29,310	4.0
Utility Gas	474,500	47,200	45,200	64,700	631,600	85.3
Totals	497,520	67,090	62,400	113,000	740,010	100.0

Table 9 SULFUR AND ASH CONTENT OF FUELS, 1967

FUEL	% Sulfur	% Ash
Coal	2.1	9.7
Residual Fuel Oil	1.25	-
Distillate Fuel Oil	0.23	-
Natural Gas	0.0008	-

Study Area are served by natural gas. The outlying areas are partially heated by distillate fuel oil and coal as well as natural gas.

Average values for the sulfur and ash contents of the fuels used in the Study Area are summarized in Table 9.[5,6]

Emissions from Fuel Combustion

Air pollutant emissions resulting from fuel combustion in stationary sources are listed in Table 10. The emissions are presented for industrial, steam-electric utility, residential, and commercial and institutional sources.

Coal accounts for approximately 99 percent of the sulfur oxides emitted from fuel combustion in stationary sources; 99 percent of the particulates, 100 percent of the carbon monoxide, 91 percent of the nitrogen oxides, and 100 percent of the hydrocarbons.

The emissions resulting from the combustion of fuel oil and natural gas are minor compared to that from coal combustion.

Data Sources

Fuel consumption data for the Study Area were obtained from diverse sources. Natural gas numbers were obtained from the gas companies in the area and are the most accurate. They were provided on a county basis with a breakdown by industry, residential, commercial and institutional source categories.

Residual fuel oil figures were obtained from the Bureau of Census for[7] 1963 and were updated by the increase in manufacturing employment. Residual fuel oil was distributed on a county basis by manufacturing employment and on a grid basis by means of land use maps.

Of the total distillate fuel oil consumed, approximately 45 percent was used for residential purposes and 45 percent for industrial purposes. Distillate fuel oil totals were also obtained from the Bureau of Census.

Table 10 AIR POLLUTANT EMISSIONS FROM COMBUSTION OF FUELS IN STATIONARY SOURCES IN PITTSBURGH STUDY AREA, 1967 (TONS/YEAR)

Fuel	User Category	Sulfur Oxides	Particulates	Carbon Monoxide	Nitrogen Oxides	Hydrocarbons
Coal	Industrial	433,400	125,400	15,700	109,300	6,000
	Steam-Electric	235,500	130,200	1,900	76,400	800
	Residential	25,200	15,300	15,800	3,150	3,100
	Commercial & Institutional	28,300	8,200	24,700	2,840	4,900
	Total	722,400	279,100	58,100	191,700	14,800
Fuel Oil	Industrial	1,670	170	10	730	10
	Steam-Electric	125	10	N	75	N
	Residential	600	130	30	195	50
	Commercial & Institutional	1,340	220	N	330	N
	Total	3,700	530	40	1,300	60
Gas	Industrial	10	810	10	9,620	N
	Steam-Electric	0	0	0	0	0
	Residential	20	955	20	5,850	N
	Commercial & Institutional	5	330	5	1,990	N
	Total	35	2,095	35	17,460	N
	Grand Totals	726,100	281,800	58,100	210,500	14,900

N = Negligible

Coal consumption data in the four county area was obtained through personal contact with the National Coal Association.[8] Residential coal by county was found from the number of dwelling units using coal and the total number of degree days for the area. This method is described in detail in the Rapid Survey Technique publication.[9]

Transportation

Four types of transportation sources of air pollution are considered in this survey - road vehicles, aircraft, vessels and railroads. Road vehicles which are by far the most significant source of air pollution in this category are further subdivided according to type of fuel - gasoline or diesel.

Road Vehicles

The miles of travel by motor vehicles in the Study Area are summarized in Table 11.[10] Vehicle mile data for major arterials and highways was obtained from a transportation study performed by the Pennsylvania State Highway Department for 1964. Through the Research Division of the Pennsylvania State Highway Department estimates were made in order to include the traffic on secondary and rural roads in each county. The 1964 data was updated to 1967 by the increase in vehicle registrations. The vehicle miles were apportioned onto grids by traffic flow maps provided by the Highway Department.

Road vehicles accounted for 87 percent of the sulfur oxides; 75 percent of the particulates; 98 percent of the carbon monoxide; 91 percent of the nitrogen oxides; and 95 percent of the hydrocarbons from all transportation sources (Table 12). Gasoline powered road vehicles contributed a greater percentage of all pollutants than diesel powered road vehicles.

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Table 11 VEHICLE MILES OF TRAVEL FOR ROAD VEHICLES IN STUDY AREA PER DAY, 1967

Type Road	Vehicle Miles				
	Allegheny	Beaver	Washington	Westmoreland	Study Area
State	9,660,000	1,746,000	2,845,000	3,352,000	17,303,000
Rural	263,000	148,000	311,000	612,000	1,334,000
Urban	6,235,000	560,000	337,000	650,000	7,782,000
TOTALS	16,158,000	2,454,000	3,193,000	4,614,000	26,419,000

Table 12 AIR POLLUTANT EMISSIONS FROM TRANSPORTATION SOURCES IN PITTSBURGH STUDY AREA, 1967 (Tons/year)

Source	Sulfur Oxides	Particulates	Carbon Monoxide	Nitrogen Oxides	Hydrocarbons
Road Vehicles	4,300	7,000	833,700	46,400	75,700
Gasoline	3,280	4,340	831,700	40,900	72,300
Diesel	1,000	2,700	1,500	5,500	3,400
Aircraft	Neg.	535	14,490	1,040	2,945
Jet	Neg.	475	670	385	385
Piston	Neg.	60	13,820	655	2,560
Railroad	520	1,430	780	2,890	1,770
Vessels	130	360	200	730	445
TOTALS	4,900	9,300	848,700	51,000	79,900

Aircraft

Table 13 shows the air traffic activity at the two largest airports in the Study Area. Total aircraft operations were supplied by the Federal Aviation Administration.[11] An operation is defined as either a takeoff or a landing.

The breakdown of all flights at each airport by engine-type is shown in Table 14. A flight is defined as a combination of a landing and a takeoff. The values in these tables are reported to as many as five significant figures but should be considered accurate to no more than two. Aircraft accounted for less than 6 percent of the total transportation emissions for any pollutant.

Railroads and Vessels

Railroads consume about 26 million gallons of diesel fuel per year in the Study Area. These figures were obtained from the various railroads in the Study Area. River vessels consume about 7 million gallons of diesel fuel per year.[12] The air pollutant emissions arising from railroad and vessel sources are insignificant when compared to other transportation sources.

Solid Waste Disposal

Approximately 2.1 million tons of refuse were generated during 1967 in the Study Area. This was determined by assuming a per capita refuse generation rate of 4.5 pounds of refuse per day.[13] Table 15 presents a solid waste balance for the Pittsburgh Study Area, showing the various methods of disposal and the quantities disposed of by each method.

Landfills accounted for 57 percent; municipal incineration 11 percent; open dumps 7 percent; on-site incineration 11 percent and on-site open burning 8 percent of the total refuse disposed. The remaining 6 percent of the total refuse generated was transferred out of the Study Area. Figure 5 shows the location of the various

Table 13

AIR TRAFFIC ACTIVITY AT GREATER PITTSBURGH AIRPORT
AND PITTSBURGH ALLEGHENY AIRPORT
FOR CALENDAR YEAR 1967

	Greater - Pittsburgh		Pittsburgh - Allegheny	
	Itinerant Operations	Local Operations	Itinerant...	Local...
Air Carrier	145,293	-	122	-
General Aviation	42,956	16,290	105,629	72,606
Military	12,535	17,087	1,151	1,098
Totals	200,784	33,377	106,902	73,704

Table 14

AIR TRAFFIC BY ENGINE TYPE

	Greater - Pittsburgh Number of Flights	Pittsburgh - Allegheny Number of Flights
Fan - Jet	29,059	24
Conventional Jet	20,595	1,019
Two Engine Piston	50,605	71,427
Four Engine Piston	16,822	17,832
Totals	117,081	90,302

Table. 13 SOLID WASTE BALANCE FOR PITTSBURGH STUDY AREA, 1967

	Total Refuse Generated	Incineration		Landfills	Dumps	Open-Burning On-Site	Transferred**
		Municipal	On-Site				
Allegheny	1,395,000	213,500	229,900	474,500	146,000*	62,000	+269,000
Beaver	185,000	14,400	--	99,100	5,800	26,000	+ 39,700
Washington	181,000	6,600	--	205,100	--	24,900	-145,600
Westmoreland	310,000	--	--	313,900	--	46,500	- 50,400
Totals	2,071,000	234,500	229,900	1,182,600	151,800	159,400	+112,700

* This includes only industrial dumping. The remaining dumps in Allegheny County are included in the landfill total.

** The + sign refers to transferred out of area and the - sign refers to transferred into area.

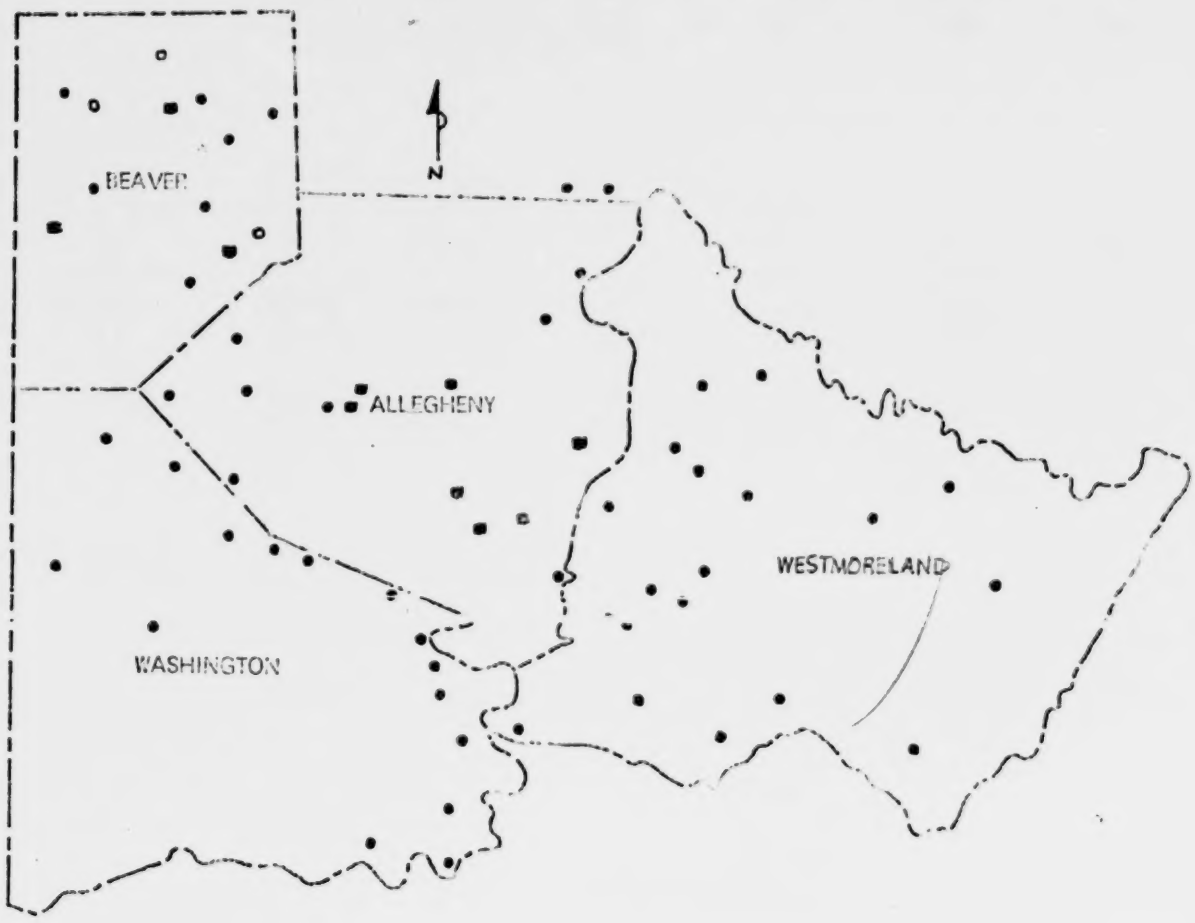

Figure 5. Solid-waste disposal sites in Pittsburgh Study Area.

- Landfill
- Municipal incinerator
- Dump

disposal sites throughout the Study Area.[14]

A total of 8,600 tons of carbon monoxide, 3,600 tons of particulate matter and 1,500 tons of nitrogen oxides were emitted from solid waste disposal practices in the Study Area (See Table 16).

Industrial Process Losses

The resources of the Study Area have been conducive to the development of many types of heavy industry. Chief among these are primary metal products, fabricated metal products, and machinery. Table 17 shows selected manufacturing establishments in the area by county for 1966.[15]

It may be noted from the table that Allegheny County accounts for the largest single percentage of almost every type of manufacturing. Fifty percent of "Stone, Clay and Glass" establishments, forty-seven percent of "primary metals" seventy percent of "fabricated metal products,"and fifty eight percent of "machinery" establishments are located in Allegheny County.

Emissions from industrial process losses are shown in Table 18. By-product coke ovens account for 95 percent of the sulfur oxides emissions from industrial processes and 28 percent of the particulates.

Data for industrial process losses were supplied by the local and state Air Pollution Departments.

EMISSIONS BY GRID

For the purpose of modeling the air pollutant emissions in the Study Area the resulting emissions were apportioned on the grid reference system shown in Figure 4.

The emissions of each pollutant were divided into two source subgroups - point and area sources. The 68 point sources were

Table 16 AIR POLLUTANT EMISSIONS FROM SOLID-WASTE DISPOSAL IN AIR POLLUTION STUDY AREA, 1967 (Tons/Year)

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Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Incineration	478	2,008	248	81	478
Municipal	244	1,030	131	44	244
On-Site	234	978	117	37	234
Open Burning	196	1,573	8,383	495	1,083
Dumps	36	303	1,613	95	208
On-Site	160	1,270	6,770	400	875
Total	675	3,580	8,630	575	1,560

TABLE 17 SELECTED MANUFACTURING ESTABLISHMENTS IN PITTSBURGH STUDY AREA, 1966

Reproduced from best available copy.

Type of Establishment	Number of Establishments				
	Allegheny	Beaver	Washington	Westmoreland	Study Area
Food and Kindred Products	270	40	54	78	442
Transportation Equipment	18	2	4	7	31
Instruments & Related Products	34	1	2	3	40
Apparel & Related Products	49	3	5	19	76
Lumber & Wood Products	31	3	12	32	78
Furniture & Fixtures	48	2	15	15	80
Paper & Allied Products	23	2	7	5	37
Printing, Publishing	289	21	27	51	388
Chemicals & Allied Products	73	8	4	10	95
Petroleum & Coal Products	19	3	2	2	26
Rubber & Miscellaneous Plastics	27	3	6	7	43
Stone, Clay & Glass Products	103	33	30	40	206
Primary Metal Products	74	25	15	43	157
Fabricated Metal Products	235	23	31	49	338
Machinery	223	25	34	103	385
Totals	1,516	194	248	464	2,422

Table 18

AIR POLLUTANT EMISSIONS FROM PROCESS LOSS SOURCES IN THE PITTSBURGH STUDY AREA
1967 (Tons/Year)

Reproduced from best available copy.

Type of Industry	SO_X	PART.	NO_X
Ferrous Metal Operations			
Blast Furnaces	---	10,800	---
Basic Oxygen Plants	---	1,900	---
Open-Hearth Furnaces	---	15,300	---
Electric Arc Furnaces	---	3,600	---
Sintering Plants	400	13,600	1,500
Cupola Furnaces	---	2,300	---
By-Product Coke Ovens	194,000	26,500	---
Non-Metallurgical			
Cement Plants	7,800	15,300	1,950
Asphalt Plants	---	600	---
Other	---	2,000	---
TOTAL	202,200	91,900	3,500

identified by source category, grid number and horizontal and vertical coordinates. Figure 6 shows the location of all major point sources in the Study Area. The point sources are presented in Table 19, along with emissions for the five pollutants for an average annual, winter and summer day. The appendix presents the method for calculating these three averages.

The emissions for area sources on the annual, winter and summer bases are shown in Table 20. The calculation of these averages is similar to that presented in the appendix for point sources.

EMISSION DENSITIES BY GRID

Emission densities on a grid basis were obtained by summing the annual area and point source emissions for each grid. This total, divided by the grid area, gives an emission density in tons per square mile per average day. Figures 7 through 11 present the emission density maps for the five surveyed pollutants.

The emission density maps for sulfur oxides, nitrogen oxides and particulates show that the highest density grids are located along the river valleys. This would be expected since all of the largest industries are located along the river valley. Also they show that Allegheny County has the greatest emissions of all four counties.

The emission density maps for carbon monoxide and hydrocarbon show that the greatest emissions occur around the center of Allegheny County. Since transportation sources are by far the biggest single source of these two pollutants, it would seem logical that at and near the city of Pittsburgh carbon monoxide and hydrocarbon emissions should be the highest.

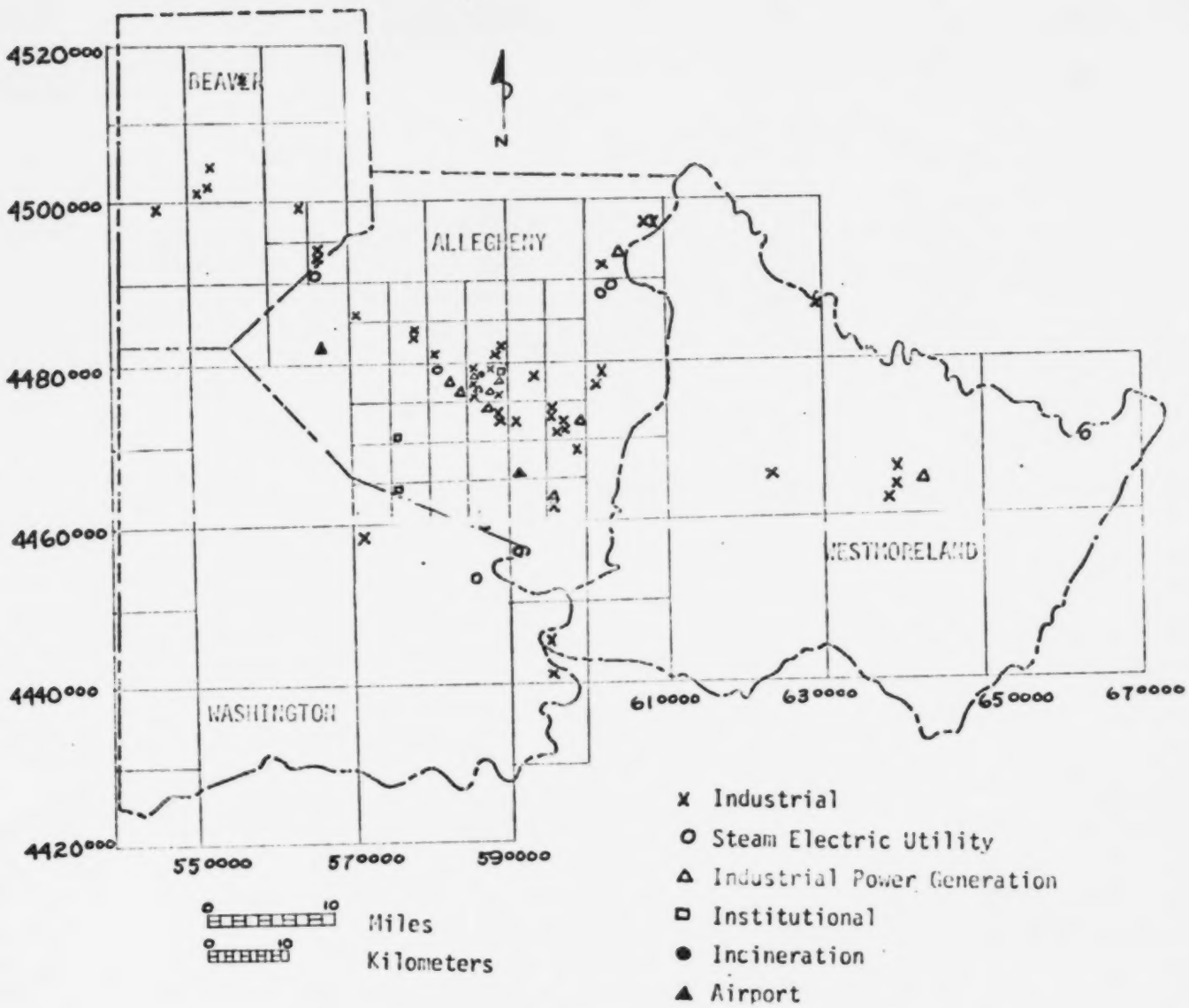

Figure 6 Point Source Location for Pittsburgh Study Area 1967

TABLE 19

SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FOR P

Source Category	Grid	HC	VC	SO_x			PART			
				S	W	A	S	W	A	S
Industrial	2	5565	45150	2.3	15.7	11.4	0.1	0.6	0.5	0.1
Industrial	5	5555	45020	5.1	49.4	25.6	0.4	4.0	2.0	0.1
Industrial	5	5570	45030	4.9	99.5	48.7	0.2	3.6	1.8	0.2
Industrial	5	5575	45050	0.4	1.9	1.1	0.8	3.6	2.1	---
Industrial	7	5465	44980	71.8	71.8	71.8	25.6	25.6	25.6	1.8
Industrial	9	5645	44980	69.7	169.3	115.8	48.1	96.8	70.6	1.1
Industrial	12	5660	44945	0.1	2.5	1.3	0.1	1.3	0.6	---
Industrial	12	5660	44940	1.1	3.5	2.2	0.2	2.1	1.1	---
S. E. Utility*	12	5652	44911	137.1	137.1	137.1	23.0	23.0	23.0	0.9
Industrial	16	6084	44969	---	---	---	1.3	1.3	1.3	---
Industrial	16	6083	44968	---	---	---	5.1	5.1	5.1	---
Industrial	16	6083	44968	---	---	---	5.5	5.5	5.5	---
Industrial	16	6034	44919	3.7	4.6	4.1	2.3	2.8	2.5	0.1
I. Power Gen.**	16	6046	44946	1.3	1.3	2.7	0.8	0.8	1.6	---

TABLE 19

ISSIONS FROM POINT SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, 1967 (TONS/DAY)

SO_x			PART			CO			NO_x			HC	
W	A	S	W	A	S	W	A	S	W	A	S	W	A
15.7	11.4	0.1	0.6	0.5	0.1	0.4	0.3	0.4	3.1	2.2	---	0.1	0.1
49.4	25.6	0.4	4.0	2.0	0.1	1.3	0.7	0.9	9.2	4.8	---	0.4	0.2
99.5	48.7	0.2	3.6	1.8	0.2	3.3	1.6	1.1	22.0	10.8	0.1	1.1	0.5
1.9	1.1	0.8	3.6	2.1	---	0.1	---	0.1	0.3	0.2	---	---	---
71.8	71.8	25.6	25.6	25.6	1.8	1.8	1.8	12.3	12.3	12.3	0.6	0.6	0.6
169.3	115.8	48.1	96.8	70.6	1.1	4.5	2.6	9.3	39.2	23.2	0.4	1.7	1.0
2.5	1.3	0.1	1.3	0.6	---	0.1	0.1	---	0.7	0.3	---	---	---
3.5	2.2	0.2	2.1	1.1	---	0.1	0.1	0.1	0.6	0.3	---	---	---
137.1	137.1	23.0	23.0	23.0	0.9	0.9	0.9	36.1	36.1	36.1	0.4	0.4	0.4
---	---	1.3	1.3	1.3	---	---	---	---	---	---	---	---	---
---	---	5.1	5.1	5.1	---	---	---	---	---	---	---	---	---
---	---	5.5	5.5	5.5	---	---	---	---	---	---	---	---	---
4.6	4.1	2.3	2.8	2.5	0.1	0.2	0.2	0.9	1.2	1.0	0.1	0.1	0.1
1.3	2.7	0.8	0.8	1.6	---	---	---	0.3	0.3	0.7	---	---	---

B

TABLE 19

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SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FOR PITTSBURG
(Continued)

Source Category	Grid	HC	VC	SOx			PART			CO	
				S	W	A	S	W	A	S	W
Airport	19	5662	44825	---	---	---	1.3	1.3	1.3	18.6	18.6
Industrial	20	5704	44855	2.2	2.2	2.2	0.3	0.3	0.3	0.1	0.1
Industrial	27	5782	44828	8.2	8.2	8.2	15.1	15.1	15.1	---	---
Industrial	27	5780	44834	25.2	25.2	25.2	3.3	3.3	3.3	---	---
Industrial	28	5812	44806	1.9	1.9	1.9	0.9	0.9	0.9	0.1	0.1
Industrial	29	5898	44823	---	---	---	1.2	1.2	1.2	---	---
Industrial	29	5882	44812	1.5	1.9	1.7	0.2	0.3	0.3	0.1	0.1
S. E. Utility*	32	6023	44878	38.8	38.8	38.8	130.5	130.5	130.5	0.3	0.3
S. E. Utility*	32	6023	44878	44.0	44.0	44.0	20.7	20.7	20.7	0.3	0.3
S. E. Utility*	32	6043	44887	92.9	92.9	92.9	19.2	19.2	19.2	0.6	0.6
S. E. Utility*	32	6043	44887	5.9	5.9	5.9	24.5	24.5	24.5	---	---
Industrial	33	6300	44860	0.7	1.1	0.9	0.4	0.7	0.5	---	---
S. E. Utility*	37	5813	44792	57.4	57.4	57.4	9.7	9.7	9.7	0.4	0.4
I. Power Gen.**	37	5849	44764	1.0	1.7	1.3	0.1	0.2	0.1	---	0.1

TABLE 19

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FROM POINT SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, 1967 (TONS/DAY)
(Continued)

PART			CO			NOx			HC		
A	S	W	A	S	W	A	S	W	A	S	W	A
---	1.3	1.3	1.3	18.6	18.6	18.6	1.8	1.8	1.8	4.2	4.2	4.2
2.2	0.3	0.3	0.3	0.1	0.1	0.1	0.6	0.6	0.6	---	---	---
8.2	15.1	15.1	15.1	---	---	---	2.1	2.1	2.1	0.1	0.1	0.1
25.2	3.3	3.3	3.3	---	---	---	---	---	---	---	---	---
1.9	0.9	0.9	0.9	0.1	0.1	0.1	0.5	0.5	0.5	---	---	---
---	1.2	1.2	1.2	---	---	---	---	---	---	---	---	---
1.7	0.2	0.3	0.3	0.1	0.1	0.1	0.4	0.5	0.4	---	---	---
38.8	130.5	130.5	130.5	0.3	0.3	0.3	10.2	10.2	10.2	0.1	0.1	0.1
44.0	20.7	20.7	20.7	0.3	0.3	0.3	11.6	11.6	11.6	0.1	0.1	0.1
92.9	19.2	19.2	19.2	0.6	0.6	0.6	24.5	24.5	24.5	0.2	0.2	0.2
5.9	24.5	24.5	24.5	---	---	---	1.6	1.6	1.6	---	---	---
0.9	0.4	0.7	0.5	---	---	---	0.2	0.3	0.2	---	---	---
57.4	9.7	9.7	9.7	0.4	0.4	0.4	15.1	15.1	15.1	0.2	0.2	0.2
1.3	0.1	0.2	0.1	---	0.1	---	0.3	0.5	0.4	---	---	---

TABLE 19

SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FOR PITTSB
(Continued)

Source Category	Grid	HC	VC	SO_x			PART			CO	
				S	W	A	S	W	A	S	W
I. Power Gen.**	37	5829	44778	0.8	0.8	0.8	2.0	2.0	2.0	---	---
Industrial	38	5880	44762	---	---	---	3.1	3.1	3.1	---	---
Industrial	38	5862	44790	---	---	---	1.2	1.2	1.2	---	---
Incineration	38	5868	44790	0.4	0.4	0.4	1.8	1.8	1.8	0.2	0.2
Industrial	38	5866	44793	2.1	2.1	2.1	0.3	0.3	0.3	0.1	0.1
I. Power Gen.**	38	5896	44771	1.7	5.3	3.4	0.3	0.8	0.5	0.1	0.2
Industrial	38	5861	44758	2.0	2.4	2.2	0.3	0.4	0.3	0.1	0.1
Industrial	38	5870	44800	2.9	2.9	2.9	0.4	0.4	0.4	0.1	0.1
Institutional	38	5898	44770	0.4	2.8	1.8	0.1	0.4	0.3	0.3	1.8
I. Power Gen.**	38	5861	44783	1.1	1.9	1.4	0.1	0.2	0.2	---	0.1
I. Power Gen**	38	5886	44753	24.4	24.4	24.0	14.2	14.2	14.0	0.2	0.2
I. Power Gen.**	38	5860	44787	2.8	2.8	2.7	1.0	1.0	1.0	---	---
Industrial	39	5943	44755	1.2	2.0	1.5	0.1	0.2	0.2	---	0.1
Institutional	42	5753	44706	2.1	3.5	2.7	0.3	0.5	0.4	1.3	2.2

TABLE 19

EMISSIONS FROM POINT SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, 1967 (TONS/DAY)
(Continued)

SO_x			PART			CO			NO_x			HC	
W	A	S	W	A	S	W	A	S	W	A	S	W	A
0.8	0.8	2.0	2.0	2.0	---	---	---	0.2	0.2	0.2	---	---	---
---	---	3.1	3.1	3.1	---	---	---	---	---	---	---	---	---
---	---	1.2	1.2	1.2	---	---	---	---	---	---	---	---	---
0.4	0.4	1.8	1.8	1.8	0.2	0.2	0.2	0.4	0.4	0.4	0.1	0.1	0.1
2.1	2.1	0.3	0.3	0.3	0.1	0.1	0.1	0.5	0.5	0.5	---	---	---
5.3	3.4	0.3	0.8	0.5	0.1	0.2	0.1	0.4	1.3	0.9	---	0.1	---
2.4	2.2	0.3	0.4	0.3	0.1	0.1	0.1	0.5	0.6	0.5	---	---	---
2.9	2.9	0.4	0.4	0.4	0.1	0.1	0.1	0.7	0.7	0.7	---	---	---
2.8	1.8	0.1	0.4	0.3	0.3	1.8	1.1	---	0.3	0.2	0.1	0.4	0.2
1.9	1.4	0.1	0.2	0.2	---	0.1	---	0.3	0.5	0.4	---	---	---
24.4	24.0	14.2	14.2	14.0	0.2	0.2	0.2	6.1	6.1	6.0	0.1	0.1	0.1
2.8	2.7	1.0	1.0	1.0	---	---	---	0.7	0.7	0.7	---	---	---
2.0	1.5	0.1	0.2	0.2	---	0.1	0.1	0.3	0.5	0.4	---	---	---
3.5	2.7	0.3	0.5	0.4	1.3	2.2	1.7	0.2	0.4	0.3	0.3	0.4	0.3

TABLE 19

SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FOR PITTSBURG
(Continued)

Source Category	Grid	HC	VC	SO_x			PART			CO	
				S	W	A	S	W	A	S	W
Industrial	44	5891	44737	90.6	90.6	90.6	11.7	11.7	11.7	---	---
Industrial	44	5896	44725	1.4	1.4	1.4	0.2	0.2	0.2	0.1	0.1
I. Power Gen.**	44	5885	44745	3.3	3.3	3.3	1.0	1.0	1.0	---	---
Industrial	45	5903	44720	---	---	---	1.8	1.8	1.8	---	---
Industrial	46	5970	44717	---	---	---	3.2	3.2	3.2	---	---
Industrial	46	5951	44731	---	---	---	2.2	2.2	2.2	---	---
Industrial	46	5972	44722	---	---	---	27.4	27.4	27.4	---	---
Industrial	46	5970	44717	0.3	0.3	0.3	20.6	20.6	20.6	---	---
Industrial	46	5951	44732	0.5	0.5	0.5	1.3	1.3	1.3	---	---
I. Power Gen.**	46	5990	44725	16.4	16.4	16.4	9.7	9.7	9.7	1.0	1.0
Industrial	47	6003	44703	13.1	13.1	13.1	26.9	26.9	26.9	---	---
Industrial	47	6010	44721	2.8	3.4	3.1	0.4	0.5	0.5	0.1	0.1
Airport	54	5910	44654	---	---	---	0.1	0.1	0.1	21.1	21.1
Industrial	55	5984	44694	---	---	---	3.5	3.5	3.5	---	---

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TABLE 19

ONS FROM POINT SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, 1967 (TONS/DAY)
(Continued)

O_x			PART			CO			NO_x			HC	
	A	S	W	A	S	W	A	S	W	A	S	W	A
.6	90.6	11.7	11.7	11.7	---	---	---	---	---	---	---	---	---
.4	1.4	0.2	0.2	0.2	0.1	0.1	0.1	0.4	0.4	0.4	---	---	---
.3	3.3	1.0	1.0	1.0	---	---	---	0.8	0.8	0.8	---	---	---
--	---	1.8	1.8	1.8	---	---	---	---	---	---	---	---	---
--	---	3.2	3.2	3.2	---	---	---	---	---	---	---	---	---
--	---	2.2	2.2	2.2	---	---	---	---	---	---	---	---	---
--	---	27.4	27.4	27.4	---	---	---	---	---	---	---	---	---
3	0.3	20.6	20.6	20.6	---	---	---	1.2	1.2	1.2	---	---	---
5	0.5	1.3	1.3	1.3	---	---	---	1.8	1.8	1.8	---	---	---
4	16.4	9.7	9.7	9.7	1.0	1.0	1.0	4.0	4.0	4.0	---	---	---
1	13.1	26.9	26.9	26.9	---	---	---	3.3	3.3	3.3	0.2	0.2	0.2
4	3.1	0.4	0.5	0.5	0.1	0.1	0.1	0.7	0.9	0.8	---	---	---
-	---	0.1	0.1	0.1	21.1	21.1	21.1	1.0	1.0	1.0	3.9	3.9	3.9
-	---	3.5	3.5	3.5	---	---	---	---	---	---	---	---	---

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B

TABLE 19

SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FOR PITTSBURGH
(Continued)

Source Category	Grid	HC	VC	SO_x S	SO_x W	SO_x A	PART S	PART W	PART A	CO S	CO W
Institutional	57	5755	44645	1.7	3.0	2.3	0.7	1.1	0.9	1.1	1.9
Industrial	61	5958	44618	352.2	352.2	352.2	45.1	45.1	45.1	---	---
I. Power Gen.**	61	5954	44620	6.5	6.5	6.5	1.9	1.9	1.9	---	---
Industrial	63	6170	44650	4.1	6.3	5.1	2.5	3.9	3.2	0.2	0.2
I. Power Gen.**	64	6440	44650	---	29.5	13.7	---	10.1	4.7	---	1.1
Industrial	64	6390	44680	0.4	0.6	0.5	1.1	1.6	1.3	---	---
Industrial	64	6380	44610	1.4	2.1	1.7	0.5	0.5	0.5	0.1	0.1
Industrial	64	6390	44630	3.2	4.9	4.0	2.9	4.4	3.6	0.2	0.4
S. E. Utility*	65	6620	44706	60.1	60.1	60.1	18.0	18.0	18.0	0.4	0.4
S. E. Utility*	67	5920	44561	178.0	178.0	178.0	62.4	62.4	62.4	1.2	1.2
S. E. Utility*	71	5877	44523	30.5	30.5	30.5	49.0	49.0	49.0	1.2	1.2
Institutional	71	5852	44592	1.2	3.0	2.4	0.1	0.3	0.2	0.8	1.9
Industrial	71	5720	44580	1.1	1.1	1.1	0.7	0.7	0.7	---	---
Industrial	72	5950	44450	12.6	19.4	15.8	2.3	3.5	2.9	0.5	0.7
Industrial	72	5945	44490	27.8	28.5	28.2	6.5	6.9	6.7	0.1	0.2

* Steam Electric Utility

** Industrial Power Generation

TABLE 19

ONS FROM POINT SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, 1967 (TONS/DAY)
(Continued)

NO_x			PART			CO			NO_x			HC	
W	A	S	W	A	S	W	A	S	W	A	S	W	A
.0	2.3	0.7	1.1	0.9	1.1	1.9	1.4	0.2	0.3	0.2	0.2	0.4	0.3
.2	352.2	45.1	45.1	45.1	---	---	---	---	---	---	---	---	---
.5	6.5	1.9	1.9	1.9	---	---	---	1.7	1.7	1.6	---	---	---
.3	5.1	2.5	3.9	3.2	0.2	0.2	0.2	1.4	2.1	1.7	0.1	0.1	0.1
.5	13.7	---	10.1	4.7	---	1.1	0.5	---	7.4	3.4	---	0.4	0.2
.6	0.5	1.1	1.6	1.3	---	---	---	0.1	0.2	0.2	---	---	---
.1	1.7	0.5	0.5	0.5	0.1	0.1	0.1	0.3	0.5	0.4	---	---	---
.9	4.0	2.9	4.4	3.6	0.2	0.4	0.3	1.5	2.4	1.9	0.1	0.1	0.1
.1	60.1	18.0	18.0	18.0	0.4	0.4	0.4	15.2	15.2	15.2	0.2	0.2	0.2
.0	178.0	62.4	62.4	62.4	1.2	1.2	1.2	46.8	46.8	46.8	0.5	0.5	0.5
.5	30.5	49.0	49.0	49.0	1.2	1.2	1.2	48.6	48.6	48.6	0.5	0.5	0.5
.0	2.4	0.1	0.3	0.2	0.8	1.9	1.5	0.1	0.3	0.2	0.2	0.4	0.3
.1	1.1	0.7	0.7	0.7	---	---	---	0.3	0.3	0.3	---	---	---
.4	15.8	2.3	3.5	2.9	0.5	0.7	0.6	3.2	4.9	4.0	0.2	0.2	0.2
.5	28.2	6.5	6.9	6.7	0.1	0.2	0.1	1.0	1.1	1.1	---	0.1	0.1

B

TABLE 20. SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR PITTSBU

Reproduced from best available copy.

GRID	LAND AREA (sq.mi)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A	S
1	38.60	0.2	0.6	0.4	0.5	0.7	0.6	10.9	10.0	10.7	0.6
2	38.60	12.7	32.3	26.2	4.3	8.5	6.4	46.7	45.2	45.7	5.7
3	38.60	14.8	25.7	19.0	4.5	7.1	5.8	26.5	25.4	26.2	5.3
4	38.60	24.3	37.5	30.5	6.1	9.6	7.8	6.2	7.3	6.7	6.8
5	38.60	59.5	229.3	138.5	15.0	53.3	25.5	47.4	52.4	49.9	16.1
6	38.60	49.1	78.0	62.7	13.4	21.8	17.4	43.7	44.1	47.2	13.8
7	38.60	72.0	73.1	72.5	26.3	26.9	26.6	17.7	16.7	17.3	11.9
8	38.60	0.1	1.0	0.5	0.4	0.9	0.6	7.8	7.5	7.7	0.5
9	9.65	94.2	209.3	147.7	54.8	108.3	79.7	23.8	27.9	25.8	17.1
10	9.65	24.3	38.3	30.9	6.2	10.1	8.1	7.9	10.1	8.5	7.0
11	9.65	0.3	2.5	1.3	0.8	2.1	1.4	16.1	15.7	16.0	1.2
12	9.65	138.5	145.2	141.6	23.8	28.9	25.7	8.9	9.4	9.2	36.6
13	38.60	0.6	0.8	0.7	1.5	1.6	1.6	33.1	31.6	32.7	2.2
14	38.60	1.3	1.6	1.4	3.2	3.2	3.2	80.6	72.5	77.3	4.6
15	38.60	0.8	0.9	0.8	0.6	0.7	0.6	46.7	42.0	44.8	2.8

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SIONS FROM ALL SOURCES BY SEASON FOR PITTSBURGH STUDY AREA, (TONS/DAY)

Reproduced from best available copy.

		CO			NO_x			HC	
A	S	W	A	S	W	A	S	W	A
0.6	10.9	10.0	10.7	0.6	0.9	0.6	0.9	0.9	0.9
6.4	46.7	45.2	45.7	5.7	8.3	3.4	4.3	1.4	4.3
5.8	26.5	25.4	26.2	5.3	7.1	6.4	2.6	2.7	2.6
7.8	6.2	7.3	6.7	6.8	10.3	8.5	0.9	1.2	1.1
23.5	47.4	52.4	49.9	16.1	52.2	32.9	5.9	7.1	6.0
17.4	43.7	44.1	47.2	13.8	20.3	17.1	4.6	5.3	5.0
26.6	17.7	16.7	17.3	11.0	12.1	12.0	2.0	2.0	2.1
0.6	7.8	7.5	7.7	0.5	0.6	0.5	0.7	0.8	0.7
79.7	23.8	27.9	25.8	17.1	50.9	32.9	2.8	4.6	3.0
8.1	7.9	10.1	9.5	7.9	10.1	8.7	1.1	1.3	1.2
1.4	16.1	15.7	16.0	1.2	1.8	1.2	1.6	1.7	1.7
23.7	8.9	9.4	9.2	36.6	38.2	37.4	1.2	1.5	1.3
1.6	33.1	31.6	33.7	2.2	2.2	2.2	3.3	3.0	3.1
3.2	80.6	72.5	77.3	4.6	4.6	4.6	7.3	6.6	7.1
0.6	46.7	42.0	44.8	2.8	2.8	2.8	4.2	3.9	4.1

SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR

Reproduced from best available

GRID	LAND AREA (sq.mi)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A
16	38.60	11.8	23.2	18.4	19.5	26.2	23.4	42.9	44.3	43.9
17	38.60	0.1	0.3	0.2	0.3	0.4	0.3	5.3	4.9	5.1
18	38.60	0.1	0.2	0.1	0.1	0.2	0.2	2.3	2.1	2.2
19	38.60	3.1	4.8	3.9	3.9	4.9	4.4	47.0	44.8	46.1
20	9.65	2.6	2.7	2.7	1.2	1.2	1.2	13.2	11.9	12.7
21	9.65	2.5	2.9	1.6	1.1	1.5	1.3	9.4	8.8	9.2
22	9.65	0.4	0.6	0.5	1.0	1.1	1.1	21.7	19.6	20.9
23	9.65	0.6	0.9	0.8	0.9	1.1	1.0	18.0	16.4	17.4
24	9.65	0.8	1.1	0.9	1.5	1.0	1.0	14.1	12.8	13.5
25	9.65	0.8	1.1	0.9	1.5	1.6	1.6	30.5	27.5	29.3
26	9.65	2.2	2.8	1.6	1.5	1.4	0.7	10.1	9.4	9.8
27	9.65	34.7	36.0	35.3	20.4	21.1	20.7	16.4	15.3	16.0
28	9.65	2.8	3.6	3.2	2.7	3.1	2.9	32.1	29.3	31.0
29	9.65	4.3	6.1	4.2	4.4	5.3	4.8	42.7	39.1	41.3
30	9.65	1.2	2.1	1.7	1.8	2.4	2.1	34.0	31.2	33.0
31	9.65	2.4	3.3	1.9	1.6	2.0	1.8	20.6	18.8	19.9

A

EMISSIONS FROM ALL SOURCES BY SEASON FOR PITTSBURGH [illegible] AREA, (TONS/DAY)

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RT.	CO			NO_x			HC			
	A	S	W	A	S	W	A	S	W	A
.2	23.4	42.9	44.3	43.9	6.5	9.[illegible]	8.3	4.4	5.3	4.8
.4	0.3	5.3	4.9	5.1	0.3	0.[illegible]	0.3	0.4	0.4	0.4
.2	0.2	2.3	2.1	2.2	0.2	0.2	0.2	0.2	0.1	0.1
.9	4.4	47.0	44.8	46.1	5.0	6.1	5.5	7.0	6.9	7.1
.2	1.2	13.2	11.9	12.7	1.7	1.[illegible]	1.5	1.9	1.0	1.0
.5	1.3	9.4	8.8	9.2	1.3	1.7	1.5	1.0	1.0	1.0
.1	1.1	21.7	19.6	20.9	1.4	1.6	0.5	2.0	1.8	2.0
.1	1.0	18.0	16.4	17.4	1.4	1.6	1.4	1.8	1.8	1.7
.0	1.0	14.1	12.8	13.5	1.2	1.4	1.3	1.4	1.3	1.3
.6	1.6	30.5	27.5	29.3	2.1	2.[illegible]	2.2	2.9	2.6	2.8
.4	0.7	10.[illegible]	9.4	9.8	1.3	1.[illegible]	1.6	1.2	1.1	1.2
.1	20.7	16.4	15.3	16.0	3.8	4.8	4.2	1.8	1.8	1.8
.1	2.9	32.1	29.3	31.0	3.9	4.[illegible]	4.3	3.0	2.8	2.9
.3	4.8	42.7	39.1	41.3	3.7	4.[illegible]	4.3	4.1	3.9	4.0
.4	2.1	34.0	31.2	33.0	2.5	3.1	2.8	3.3	3.0	3.1
.0	1.8	20.6	18.8	19.9	1.9	2.4	2.2	2.1	2.0	2.0

TABLE 20. SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR

GRID	LAND AREA (sq.mi)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A
32	38.60	185.7	187.6	186.6	199.5	200.3	199.9	78.9	71.6	72.0
33	154.40	38.0	63.1	49.9	10.6	18.3	14.4	31.2	34.1	32.7
34	38.60	0.5	0.8	0.4	0.4	0.8	0.6	10.1	9.5	9.9
35	9.65	0.2	0.5	0.4	0.7	0.8	0.7	11.8	10.8	11.4
36	9.65	0.6	1.4	1.0	1.4	1.9	1.6	19.2	17.7	18.7
37	9.65	60.8	63.1	61.9	15.4	16.8	16.0	66.7	61.0	64.5
38	9.65	40.2	49.3	44.3	29.0	31.1	29.8	114.4	105.5	111.1
39	9.65	5.0	8.5	6.6	4.7	6.2	5.4	79.1	72.2	76.4
40	9.65	1.3	2.1	1.7	2.2	2.5	2.3	43.7	39.6	42.1
41	9.65	0.3	0.2	0.2	0.4	0.5	0.5	6.4	5.8	6.2
42	9.65	4.5	7.3	4.9	2.0	3.0	2.5	28.2	30.0	27.8
43	9.65	1.5	3.3	2.4	2.7	3.8	3.2	60.3	55.1	58.3
44	9.65	97.5	98.8	98.1	16.6	17.2	16.8	80.2	72.5	77.1
45	9.65	5.4	5.8	4.6	7.3	8.6	7.3	52.0	47.7	50.4
46	9.65	19.2	20.6	19.9	68.6	69.4	69.0	42.2	38.7	40.8
47	38.60	18.6	21.2	19.9	32.1	33.1	32.6	109.0	98.9	105.0

45 A

EMISSIONS FROM ALL SOURCES BY SEASON FOR [illegible] AREA, (TONS/DAY)

PART.			CO			NO			HC	
W	A	S	W	A	S	W	A	S	W	A
0.3	199.9	78.9	71.6	72.0	53.7	54.6	54.2	7.8	7.3	7.8
8.8	14.4	31.2	34.1	32.7	11.9	18.1	14.9	3.5	4.5	3.9
0.8	0.6	10.1	9.5	9.9	0.6	0.6	0.6	0.8	0.9	0.9
0.8	0.7	11.8	10.8	11.4	0.8	1.1	0.9	1.2	1.1	1.1
1.9	1.6	19.2	17.7	18.7	1.5	2.1	1.8	1.9	1.8	1.9
6.8	16.0	66.7	61.0	64.5	20.0	21.8	20.9	6.4	6.0	6.3
1.1	29.8	114.4	105.5	111.1	16.6	19.4	17.9	13.4	10.2	10.5
6.2	5.4	79.1	72.2	76.4	6.2	8.2	7.2	7.3	7.0	7.2
2.5	2.3	43.7	39.6	42.1	3.0	3.4	3.2	4.1	3.7	3.9
0.5	0.5	6.4	5.8	6.2	0.5	0.6	0.6	0.7	0.6	0.7
3.0	2.5	28.2	30.0	27.8	2.6	3.6	3.1	2.9	3.0	2.9
5.8	3.2	60.3	55.1	58.3	3.9	5.4	4.7	5.6	3.2	5.4
7.2	16.8	80.2	72.5	77.1	6.4	7.1	6.8	7.5	6.9	7.2
4.6	7.3	52.0	47.7	50.4	4.3	5.8	5.1	5.0	4.8	5.0
7.4	69.0	42.2	38.7	40.8	10.3	11.3	10.7	4.0	3.8	3.9
4.1	32.6	109.0	98.9	105.0	10.3	11.3	10.9	0.6	1.9	1.3

B

GRID	LAND AREA (sq. mi)	SO_x			PART.			CO		
		S	W	A	S	W	A	S	W	A
48	38.60	0.1	0.4	0.2	0.1	0.3	0.2	2.6	2.6	2.6
49	154.40	81.6	126.9	103.1	21.5	33.3	27.2	55.4	56.3	56.8
50	9.65	0.2	0.5	0.2	0.4	0.5	0.4	4.7	4.3	4.5
51	9.65	2.3	3.2	1.8	1.4	1.9	1.7	15.3	14.2	14.9
52	9.65	0.5	1.1	0.8	1.3	1.7	1.5	28.8	26.7	27.6
53	9.65	0.5	1.0	0.7	1.2	1.6	1.4	27.7	25.2	26.7
54	9.65	1.8	2.9	2.4	2.2	2.7	2.5	48.4	46.1	47.5
55	9.65	1.4	2.4	1.9	6.0	6.6	6.3	33.6	28.6	31.3
56	9.65	0.1	0.6	0.3	0.2	0.6	0.4	3.0	3.1	3.1
57	9.65	1.9	3.6	2.7	1.3	2.5	1.6	11.8	11.7	11.8
58	9.65	0.2	0.3	0.3	0.6	0.6	0.6	10.2	9.2	9.8
59	9.65	0.3	0.4	0.3	0.7	0.8	0.7	12.9	11.7	12.5
60	9.65	1.7	2.8	2.2	1.9	2.4	2.2	19.2	16.8	17.6
61	9.65	359.5	360.1	359.8	48.3	48.7	48.5	13.3	12.3	12.9
62	38.60	9.6	16.5	12.9	3.4	5.7	4.5	27.5	26.7	27.3
63	154.40	51.6	92.4	70.8	17.1	33.1	24.5	91.4	94.4	93.3

ART.	CO					NO_x	HC			
	A	S	W	A			A	S	W	A
.3	0.2	2.6	2.6	2.6	0.2	0.2	0.2	0.2	0.2	0.2
5	27.2	55.4	56.3	56.2	23.2	34.4	28.5	6.2	7.0	6.7
5	0.4	4.7	4.3	4.5	0.5	0.7	0.6	0.5	0.5	0.5
9	1.7	15.3	14.2	14.9	1.6	2.2	2.0	1.6	1.5	1.5
7	1.5	28.8	26.7	27.8	1.8	2.4	2.1	2.7	2.5	2.6
6	1.4	27.7	25.2	26.7	1.7	2.8	2.0	2.6	2.4	2.5
7	2.5	48.4	46.1	47.5	3.6	4.2	3.8	6.7	6.5	6.6
6	6.3	33.6	28.6	31.3	5.5	6.3	4.0	3.1	2.9	3.0
8	0.4	3.0	3.1	3.1	0.2	0.4	0.2	0.3	0.3	0.3
7	1.6	11.8	11.7	11.8	0.9	1.2	1.0	1.2	1.4	1.3
	0.6	10.2	9.2	9.8	0.7	0.8	0.8	1.0	0.9	1.0
1	0.7	12.9	11.7	12.5	1.0	1.0	1.0	1.3	1.2	1.2
	2.2	19.2	16.8	17.6	2.0	2.7	2.3	1.9	1.8	1.9
	48.5	13.3	12.3	12.9	3.0	3.4	3.2	1.3	1.4	1.4
	4.5	27.5	26.7	27.3	4.2	5.7	5.0	2.6	2.7	2.6
	24.5	91.4	94.4	93.3	17.4	20.0	21.5	8.9	10.7	9.9

TABLE 20. SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR

GRID	LAND AREA (sq.mi)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A
64	154.40	24.1	72.4	46.6	10.7	29.1	19.2	45.7	47.7	46.9
65	154.40	60.2	62.3	61.2	18.3	19.6	18.9	6.5	7.2	6.9
66	38.60	0.1	0.2	0.2	0.2	0.3	0.2	3.6	3.3	3.5
67	38.60	178.5	179.6	179.2	63.8	64.5	64.2	29.3	27.3	28.5
68	38.60	0.4	1.3	0.9	0.4	1.4	0.9	9.2	8.5	8.4
69	38.60	0.4	0.4	0.3	0.3	0.3	0.4	7.4	6.9	7.2
70	154.40	82.8	137.8	108.9	23.5	41.2	31.8	105.6	107.3	107.1
71	154.40	54.3	75.4	64.6	58.1	65.9	61.8	92.2	90.6	92.2
72	38.60	204.1	308.2	253.4	50.2	79.4	64.0	65.6	76.0	70.9
73	38.60	0.4	1.1	0.7	0.9	1.3	1.1	22.6	20.8	21.9
74	154.40	1.5	9.0	5.0	3.6	7.9	5.6	93.8	88.3	92.1
75	154.40	0.9	3.5	2.2	2.3	3.7	3.0	58.4	54.0	56.7
76	154.40	0.1	1.5	0.8	0.4	1.3	0.8	8.4	8.5	8.5
77	38.60	0.1	0.1	0.1	0.2	0.2	0.1	2.3	2.1	2.2
78	38.60	40.8	64.4	52.0	10.2	17.2	13.4	13.5	16.1	14.8
79	38.60	0.0	0.1	0.0	0.1	0.1	0.1	0.5	0.5	0.5
80	154.40	0.1	1.0	0.5	0.2	0.8	0.5	5.2	5.2	5.2
81	154.40	0.3	3.5	1.8	0.6	2.6	1.5	14.8	15.3	15.1

47
A

ISSIONS FROM ALL SOURCES BY SEASON FOR [illegible] STUDY AREA. (TONS/DAY)

RT.	CO				NO_x		HC			
	A	S	W	A	S	W	A	S	W	A
.1	19.2	45.7	47.7	46.9	9.7	21.7	15.2	4.5	5.6	5.9
.6	18.9	6.5	7.2	6.9	15.6	15.9	15.7	0.7	0.9	0.8
.3	0.2	3.6	3.3	3.5	0.2	0.2	0.2	0.3	0.3	0.3
.5	64.2	29.3	27.3	28.5	48.5	48.8	48.7	3.0	3.0	3.0
.4	0.9	9.2	8.5	8.4	0.6	0.8	0.7	0.7	0.9	0.7
.5	0.4	7.4	6.9	7.2	0.5	0.4	0.4	0.6	0.7	0.7
.2	31.8	105.6	107.3	107.1	26.0	38.0	31.7	10.7	12.4	11.6
.9	61.8	92.2	90.6	92.2	60.1	62.7	60.8	9.1	9.8	9.5
.4	64.0	65.6	76.0	70.9	48.3	73.2	60.1	8.5	11.6	10.0
.3	1.1	22.6	20.8	21.9	1.3	1.2	1.3	4.8	4.4	4.6
.9	5.6	95.8	88.8	92.1	5.3	5.2	5.6	8.4	8.1	8.5
.7	3.0	58.4	54.0	56.7	3.2	3.1	3.4	5.2	5.0	5.1
.3	0.8	8.4	8.5	8.5	0.5	0.7	0.6	0.7	0.8	0.8
.2	0.1	2.3	2.1	2.2	0.2	0.1	0.2	0.2	0.1	0.2
.2	13.4	13.5	16.1	14.8	10.9	16.2	13.6	1.9	2.0	2.2
.1	0.1	0.5	0.5	0.5	0.1	0.1	0.1	0.0	0.1	0.0
.8	0.5	5.2	5.2	5.2	0.3	0.1	0.4	0.5	0.5	0.5
.6	1.5	14.8	15.3	15.1	0.8	1.2	1.1	1.4	1.6	1.4

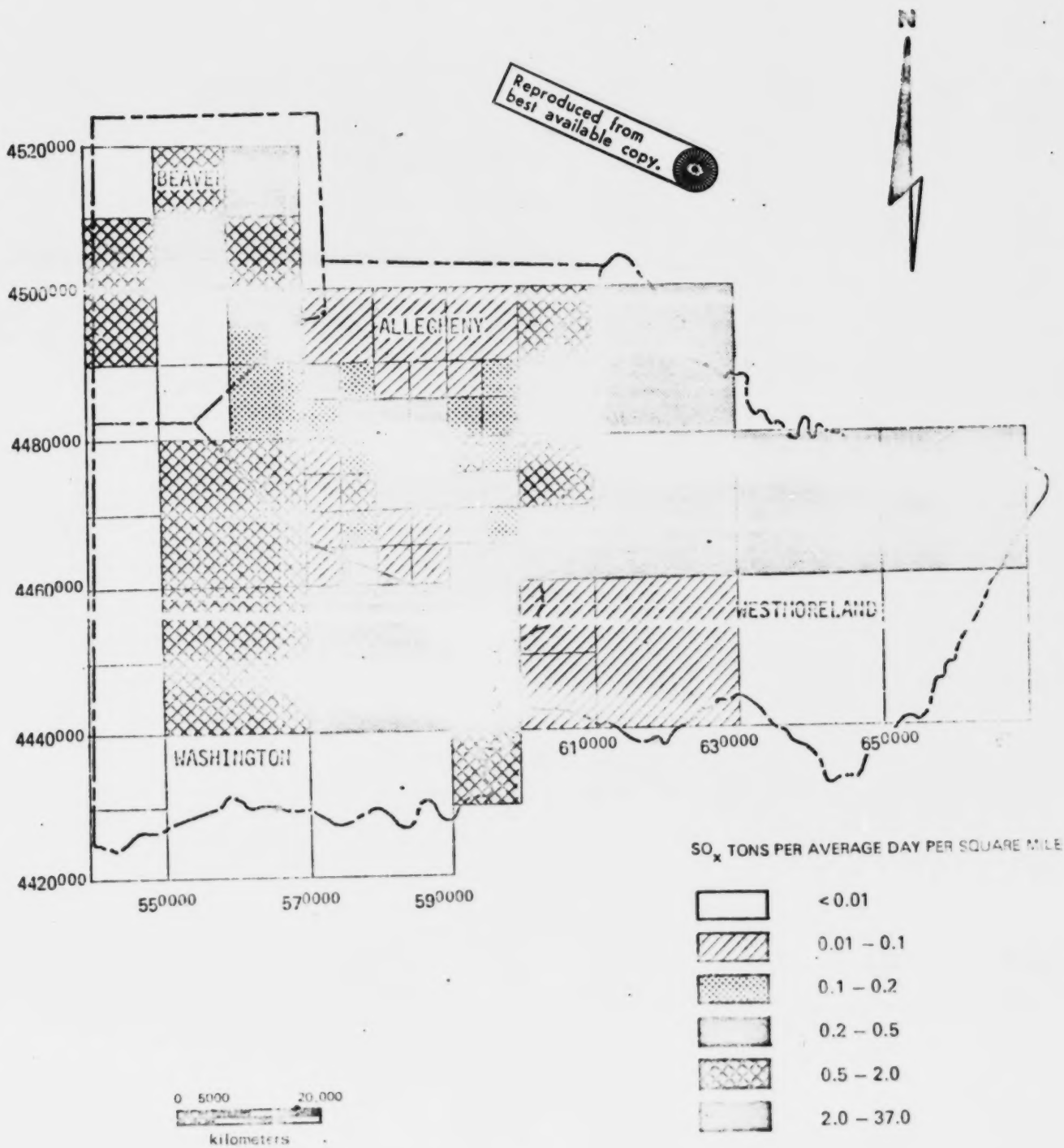

Fig. 7. Sulfur oxides emission density for all sources.

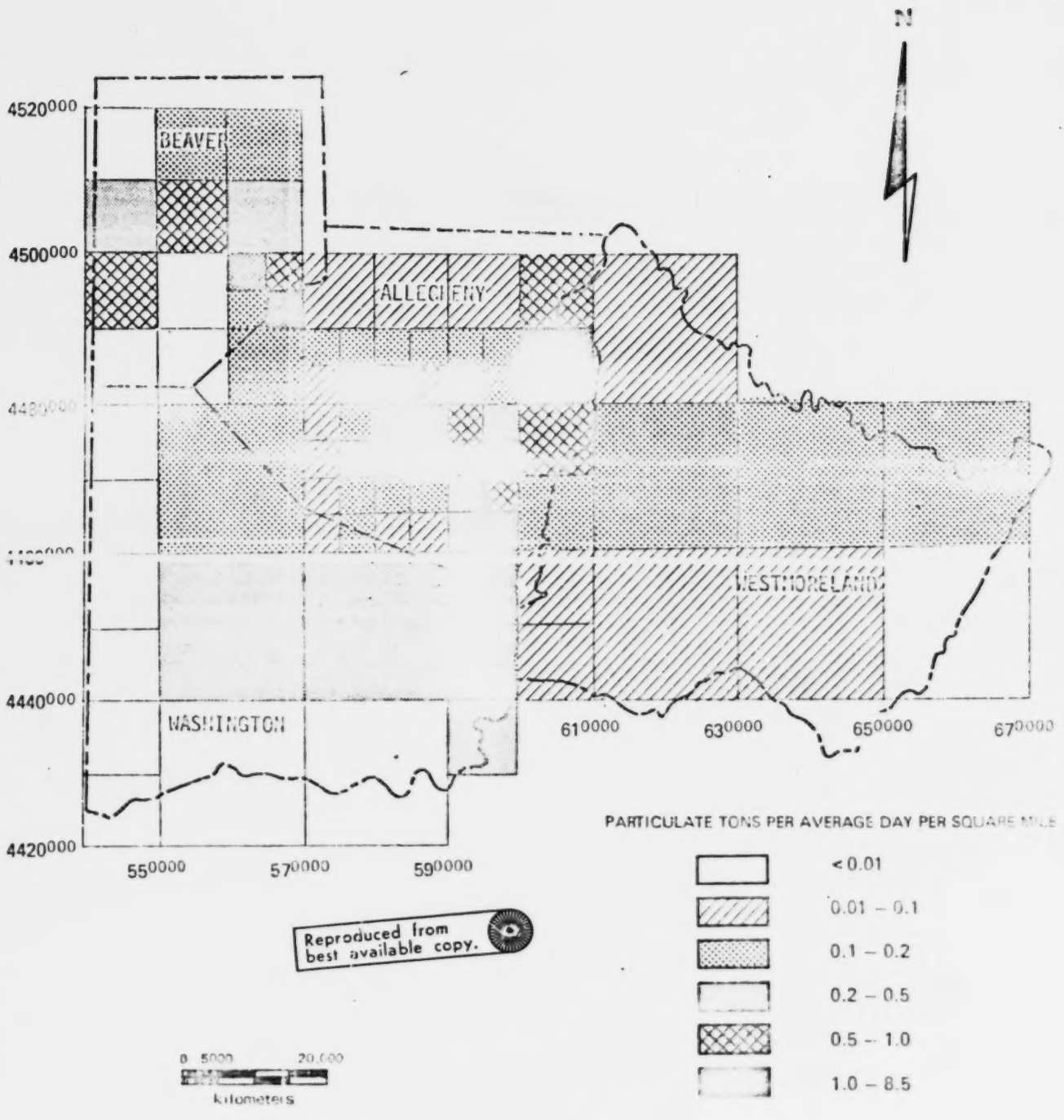

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Figure 3. Particulate emission density from all sources.

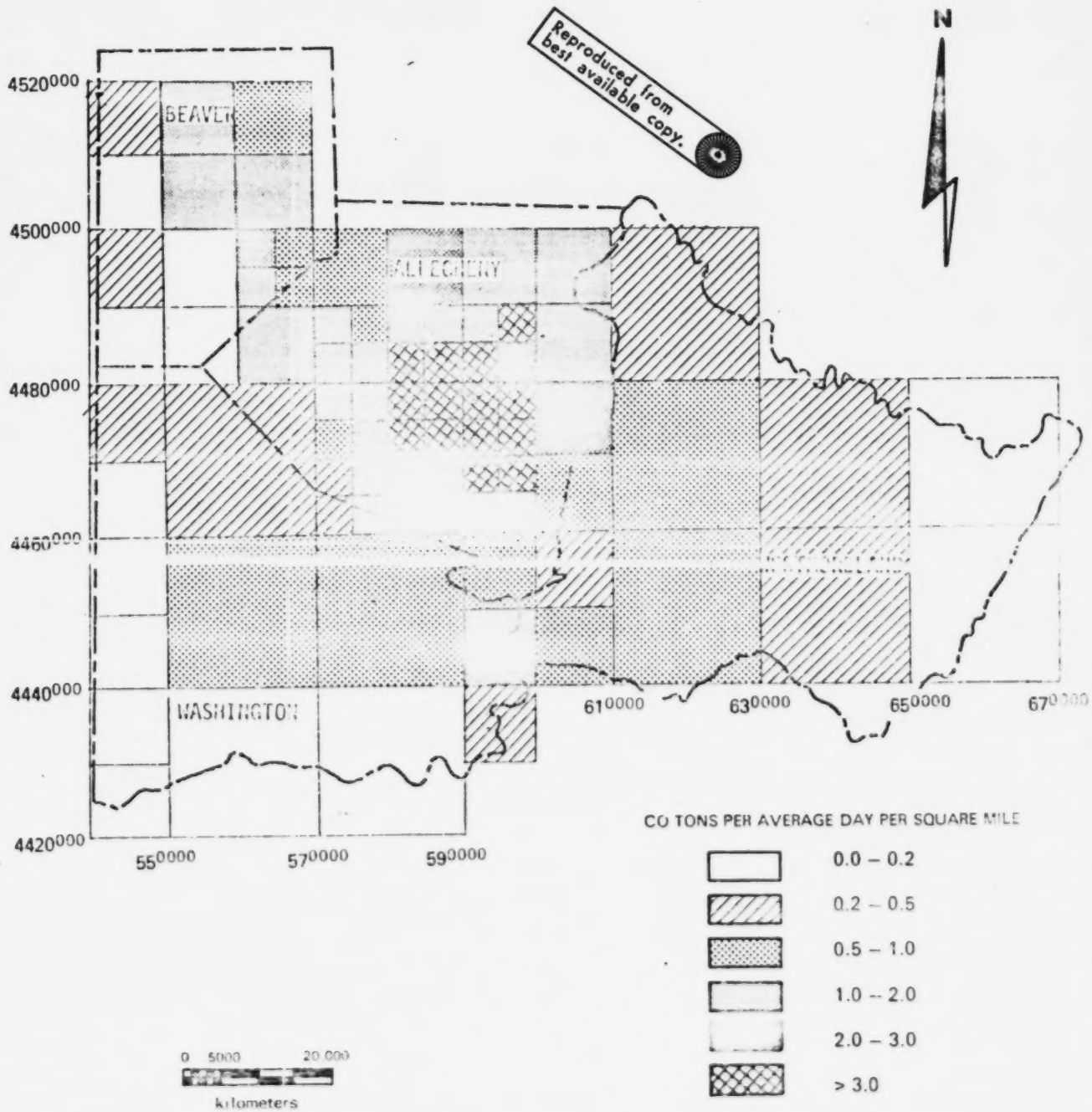


Figure 9. Carbon monoxide emission density from all sources.

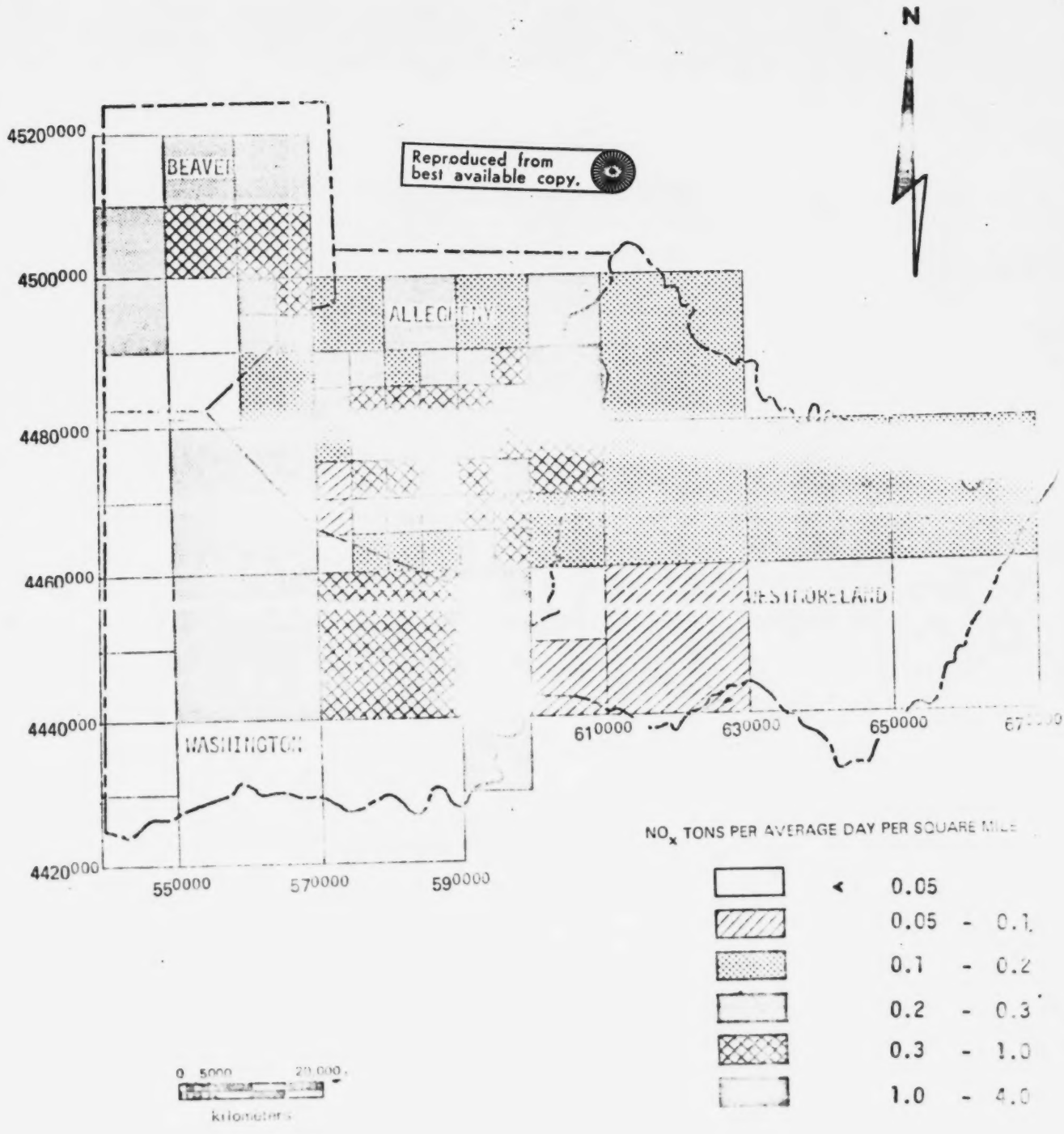
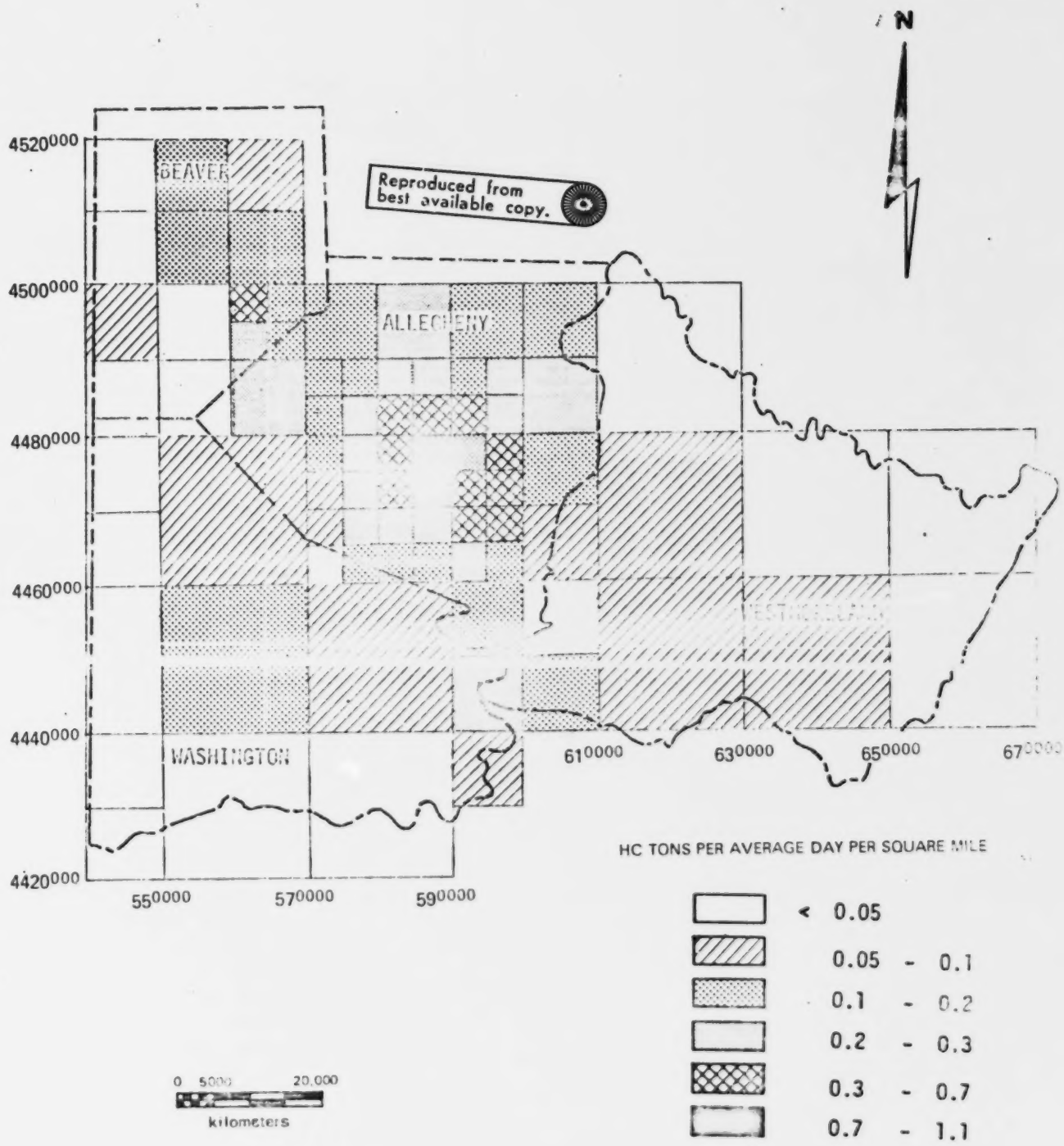


Figure 23. Nitrogen oxides emission density from oil sources.



12. [illegible] emissions density from all sources.

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APPENDIX

METHOD FOR CALCULATING SUMMER, WINTER AND ANNUAL

AVERAGE EMISSIONS FOR FUEL CONSUMPTION IN STATIONARY SOURCES

YEARLY AVERAGE (A)

$$A = \frac{\text{Fuel Consumed} \times \text{Emission Factor (E.F.)}}{\text{Days of Operation}}$$

e.g. A plant consumed 100,000 tons of coal in 1967 while operating 365 days. The total degree days for the area was 4,800 and 2,800 for the three winter months. The plant was estimated to use 15 percent of the fuel for space heating and 85 percent for process heating. From this information, the annual average emission for carbon monoxide would be the following:

$$A = \frac{100,000 \text{ Tons/Year} \times 3 \text{ lbs. C/ton coal}}{365 \text{ Days/Year} \times 2000 \text{ lbs/Ton}}$$

$$A = 0.41 \text{ Ton/Day}$$

NOT REPRODUCIBLE

WINTER AVERAGE (W)

$$W = \frac{\text{Fuel Consumed} \times \text{E.F.}}{\text{Days of Winter Operation}} \times \frac{\text{Winter Degree Days}}{\text{Total Degree Days}} \times \text{for space heating}$$

$$+ \frac{\text{Fuel Consumed} \times \text{E.F.}}{365} \times \text{\% fuel used for process heating}$$

$$W = \left[\frac{100,000 \times 2,800}{90 \times 4,800} \times 0.15 + \frac{100,000}{365} \times 0.85\right] \frac{1}{2,000} \frac{3}{}$$

$$W = 0.49 \text{ Ton/Day}$$

SUMMER AVERAGE (S)

$$S = \frac{\text{Fuel Consumed} \times \text{E.F.}}{\text{Days of Summer Operation}} \times \frac{\text{Summer Degree Days}}{\text{Total Degree Days}} \times \text{for space heating}$$

$$+ \frac{\text{Fuel Consumed} \times \text{E.F.}}{365} \times \text{\% fuel used for process heating}$$

$$S = \left[\frac{100,000}{90} \times \frac{0}{4,800} \times 0.15 + \frac{100,000}{365} \times 0.85\right] \frac{3}{2,000}$$

$$S = 0.35 \text{ Ton/Day}$$